Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. ROB'T MCKEAN, Treas.
505 Pearl St., New York.

Monadnock Bldg., Chicago.
6 Bouverie Street, London, E. C.
Unter den Linden 71—Berlin N. W. 7.

WALTER RENTON INGALLS, Editor.

Subscriptions payable in advance, $5.00 a year for 52 numbers, including postage in the United States, Mexico, Cuba, Porto Rico, Hawaii, or the Philippines, $6.50 in Canada.

To foreign countries, including postage, $8.00 or its equivalent, 33 shillings: 33 marks: or 40 francs.

Notice to discontinue should be written to the New York Office in every instance.

Advertising copy should reach New York Office by Thursday of week before date of issue.

Entered at New York Post Office as mail matter of the second class.

Cable Address, Engminjour, N. Y.

CIRCULATION STATEMENT

Of this issue 9000 copies are printed.

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

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The Engineering and Mining Journal

Vol. 93. APRIL 27, 1912. No. 17

The Slime Problem

The greatest of all metallurgical problems at the present time is, we think, the slime problem. By this we have no reference to the cyanide process, wherein the treatment of slime is now well managed, but rather to that of ordinary gravity concentration by the medium of water. Many millions of tons of tailings, containing from 10 to 20 lb. of copper per ton, are discharged annually from our dressing works as irreclaimable waste. While our smelters are able to extract upward of 95% of the copper delivered to them, our millmen get only 65 to 70%, exceeding the higher figure in but occasional instances. In the treatment of lead and zinc ores, the conditions are similar.

In making these statements we have no intention of depreciating the accomplishment of the millmen. In fact their achievements have not lagged behind those of either miner or smelter. If they are extracting only two-thirds of the mineral of their ore, they are, nevertheless, getting that from ore that but 10 years ago was scarcely dreamed to be capable of yielding anything. In the treatment of most of the disseminated copper ore, it is necessary to start in with a reduction in size that formerly was unheard of, and by the time that regrinding has been done, the pulp has become nearly all slime and the proportion that passes a 200-mesh sieve is high. Yet the recognition of this brilliant success in ore treatment does not prevent us from experiencing an uncomfortable and unsatisfactory feeling, as we watch the streams running down the tail-races.

Every manager is thinking about this and is groping for some improved method. Elaboration of the roughing system of concentration, the trial of new kinds of tables, experimentation with centrifugal separators are some of the refinements that are being considered and tried. Incidentally there is being given much attention to the development of hydrometallurgical processes, meaning lixiviation and chemical precipitation of the metal, and it is not unlikely that something useful in that direction may be developed, for copper extraction, anyway.

Hydrometallurgical processes for copper extraction are no new thing, but they have survived only for the treatment of special kinds of ore, and at the present time are but of limited application. Barring the Bradley process at Anaconda, which is not yet in regular operation, the only concerns in the United States that are extracting copper by wet methods, so far as we are aware, are the Arizona Copper Co. and the Pennsylvania Salt Manufacturing Company.

We understand, however, that the introduction of certain hydrometallurgical processes is being seriously contemplated by some other companies.

Hydrometallurgical processes for copper extraction have never received the attention from the mechanical standpoint that they have deserved. It is possible that some old methods may be successfully rejuvenated by the same kind of mechanical development that has attended the cyanide process for gold and silver extraction, especially in the field of silver metallurgy, wherein this wet process became a wonderfully useful thing after the old hyposulphite process passed out of use. It is not unlikely that it will be some hydrometallurgical process to which we must look for the ultimate solution of the slime problem in the case of copper ore.

Baltic Mining Method

Considered in their essentials, the methods of mining employed at the various amygdaloid copper mines at Lake Superior do not differ greatly. This is also true of the operations on the conglomerate lodes. For each of these two formations, from which the copper production of the Lake district is obtained, a general method of underground working has been evolved during the last 50 years. With one exception, it has been

found possible to apply these methods successfully throughout the district, with certain slight changes necessitated by conditions peculiar to the individual mines. This one exception is the Baltic mine, or rather, the Baltic, Champion and Trimountain mines of the Copper Range Consolidated Company.

When mining started at the three properties, the methods employed were those that had been used with success at other steep-dipping amygdaloid mines of the district. It was not long, however, before it was seen that these could not be applied with equal success at the mines in question. The reason for this was a peculiar combination of conditions and subsequent work has indicated that this combination obtains only in these three mines on this lode. To meet these conditions a method of mining was worked out by Mr. Denton and has resulted in giving the Copper Range Consolidated Co. an enviable position among the low-cost producers in the Lake Superior district. This method is generally known as the "Baltic method," and its distinctive features are: Mining on a waste filling; dry-wall drifts and mill holes; underground sorting, and mining of the level pillars by "caving." Some of the conditions which precluded the successful use of the plans first used were found eventually to be adapted admirably to the present method. The Baltic method as it is today was not, of course, worked out "over night."

Owing to the steep dip of the lode the open-stope method was impracticable; the great vertical distance between foot and hanging walls made it impossible to rig up a machine drill without a filling of some sort on which to work. Serious defects were soon discovered in the ore-filled method when it was applied to the Baltic lode. Compared to the other amygdaloid lodes, the ore in the Baltic is wider, the copper occurs more in pockets, and many of the latter are in the footwall. With the ore-filled method many of these pockets were lost and because of this and the bunchy occurrence of the copper in the lode, the grade of the rock hoisted was too low. These objections and the tendency of the rock to break in tabular form suitable for the building of dry walls, led to the adoption of the present method. The failure of the old system and the gradual evolution of the new one, are well described in a series of three articles by Claude T. Rice, the first of which appears elsewhere in this issue of the JOURNAL.

Cyanidation of Concentrate

The concentration of gold and silver ores has made possible the cyanidation of low-grade material in some districts where preliminary roasting or direct cyanidation had proved inadequate. In the process of concentration not only is a fair proportion of the precious metals removed but also much of the more refractory material which makes direct chemical treatment unprofitable.

Since the material removed as concentrate is usually in the form of sulphides, arsenides or tellurides, a preliminary roast may make the ore amenable to cyanidation, thus avoiding the necessity of concentration, and this system is used in some districts, but it is not applicable in others because of high fuel and operating costs. When low-grade sulphide ores are to be treated, excessive cyanide consumption is likely to be the drawback to direct cyanidation. Whether concentration or roasting, or a combination of both is the auxiliary method to use is a question that can be decided only according to individual circumstances.

When it comes to the treatment of the concentrate after removal from the pulp still further options are open to the operator. Formerly, the general procedure was to ship to the smelter and this method is still advantageous in many instances. This is especially true of mills so favorably situated with reference to the smelter that the bonus received for iron in the concentrate largely bears the burden of freight and treatment charges.

In recent years, however, the subject of treatment of the concentrate at the mill has received a good deal of attention, and striking examples of the feasibility of this practice are given in the Goldfield Consolidated, the Oriental Consolidated and the Alaska-Treadwell mills. Excessive freight rates on high-grade concentrates in at least two of these cases made it easy to decide in favor of cyanide treatment at the mill. The net saving by cyaniding the concentrate at the Alaska-Treadwell mill on Douglas Island, rather than shipping to the Tacoma smeltery, is given at $6.22 per ton.

Notwithstanding the favorable results obtained at these mills, this method is not capable of universal application as is well brought out by E. M. Hamilton in an article in this issue of the JOURNAL. Mr. Hamilton presents the factors to be considered in deciding the question of how best to handle concentrates from silver-gold ores, which should be an aid to operators having this situation to meet.

A very agreeable sentiment was created in the Lake Superior copper country last week by the voluntary action of the Calumet & Hecla in raising the wages of its men by 10%, which action was promptly followed by the Copper Range, Quincy and other companies. The leading interests have faith in the stability of the copper market at or near the present level, and as more money is being made, are disposed to share their good fortune with their employees, especially inasmuch as wages were reduced in 1907. The particularly gratifying feature of the advance at Lake Superior is that the Calumet & Hecla did not wait to be asked but acted upon its own initiative. The relations between this company and its employees are ideal in many respects and afford a model that may well be imitated elsewhere.

The continual steady drain of gold to India and the position of the reserves in that country has led the Indian government to consider seriously the substitution of a gold coinage for part of the silver rupees now in circulation. The present proposition is to coin 10-rupee gold pieces experimentally; and it is expected that they will be taken largely in place of the current silver.

The "Titanic" disaster took a heavy toll from the mining world, as an obituary page this week bears evidence. The list includes names well known in mining and metallurgy and in the iron and steel industry. Nearly all, apparently, had many years of usefulness before them, and all will be missed in their chosen professions.

There is considerable discussion already about the future disposition of the Great Northern ore lands, though over two years must elapse before the present leases terminate. It is said that the trustees have already received some tentative offers for part of the lands.

By the Way

Since the postal authorities have taken it upon themselves to protect defenceless card-indexed investors against the literary persuasions of stock swindlers, a new field of industry has opened itself to a class of sleek individuals who seek out the gullible in person, says the *Evening Post*. It is dangerous to swindle by mail, but if worthless stocks can be sold direct by personal solicitation, there is nobody to interfere. Thousands of men are now going about the country peddling mining and other stocks, like book agents.

All engineers have had experience with fabricated fancies of the uninformed, in which various ores are claimed to contain metals in excess of the amounts allowed by nature. In this connection the "explanation" of a Canadian "expert," who was caught in the act of submitting a piece of impure, coarsely crystalline pig iron as a sample of his alleged iron "find," is unique and heroic. On failing to find on the ground any body of "ore" of the grade and character of his exhibited sample, he justified himself by claiming that the "sample" which he had taken had happened to be from the exact spot where lightning had struck at some time, and thus created an actual fusion and concentration of the rock. His companions, needless to say, were also "struck" by the explanation, but not entirely satisfied by it.

If you can read the following letter fast enough, you may be interested in some of the mining propositions offered therein. It is presented in the original "Esperanto" text as typed by the vice-president and general manager of the ——— ——— Mining, Milling and Smelting Co., typists being scarcer in Nevada than in New York: "Maech Th 24, 1912. Dr Ser: I Sce Det Jo Are Lokin For Mainineg Prapperty I Have All Moste Anything Det Jo Ere Loking Forr Ine Maining Det Jo kann Mensen I Heve Tventy Faive Klemes Joining Gold King Ann De IstsaidEscv Ruenes $5 To 10 Perr Tonn Wi Er Workien An Gold King Whi Hevv Ore Roenes From $100 To $5000 Perr Tonn Ikann Sened Sempeles Ef Rekvaier red De Groened Will Stend De Teste Atet Anytaiem Jo Woses to Loket Over I intent To Bild A Smelter Des Somar. Joors Troly, ——— ———."

The "Corner House," so frequently referred to in Rand mining matters, is now the sobriquet for the Central Mining Investment Corporation, Ltd. Originally it referred to the firm of H. Eckstein & Co., the Johannesburg representatives of the mining house of Wernher, Beit & Co. which was liquidated on Jan. 1, 1912. For years, the offices of its representatives, H. Eckstein & Co., in the house at the corner of Commissioner and Simmond streets, directed many of the Rand's leading mining enterprises, such of the older mines as City & Suburban, Crown Reef, Robinson, Ferreira, etc.; later they organized some of the chief mines of the first row of deep levels into the Rand Mines, Ltd., and other groups such as the Geldenhuis Estate, the Modderfonteins, Crown Mines, etc., constituting a list too extended to be mentioned here. The old corner house at Commissioner and Simmond streets has now been replaced by a modern office building known as the Corner House Building. The old Wernher-Beit properties and their operations are still discussed as the doings of "Corner House."

In the Florida phosphate fields, the removal of the overburden which occurs generally as a feature of the beds of phosphate rock is a matter of much concern to the engineers responsible for the cost-sheet results, and is hence a subject of frequent discussion. At a recent meeting in the field, the engineer was talking about "overburden," when Pat, the foreman, who had found in his particular deposit that the varying depth and irregular limestone floor was a matter of more operating concern, remarked that it wasn't the "over" burden that was bothering him, but the "under" burden. In this he spoke wiser than he knew, for it is the "under" burden of many a deposit of ore that has been the fatal obstacle to the engineering and financial success of an operation. In other words, orebodies do end in depth somewhere, and the locus of this ending is often the problem of problems as to the life and value of the mine.

The text this morning will be found in Matt. XV, 14; if all the surveyors are down in the mine and there isn't a Brunton pocket transit in the office with which to find it, it says: "And if the blind shall lead the blind, both shall fall into the ditch." William Barrett Ridgely, former comptroller of the currency, recounted recently in the Supreme Court in New York that one James Graham Allen, a promoter, represented that he owned certain mining rights at Holguin, Cuba, where the land contained deposits of gold in a quantity and of a quality suitable for commercial purposes. Mr. Ridgely says that Mr. Allen exhibited samples which indicated that the deposits were very rich and afterward took him over the land and pointed out a considerable acreage as the property in question. "He represented that the land was rich in placer gold," says Mr. Ridgely, according to the *Sun*, "and that there were veins rich in gold and conglomerate" —whatever sort of coin that may be. "He had had the land examined by mining experts," continued Mr. Ridgely; "the gold deposits surveyed and the ore analyzed; and further, warranted that the property would yield a minimum of $4 to $5 per ton pure gold over a broad area." As a result of these representations, Mr. Ridgely says he believed in them absolutely and since he was not a mining engineer, he could not determine the truth of the representations personally. Allen offered for $10,000 his allotment of 100,000 shares in a corporation formed to take over the property. This offer Mr. Ridgely accepted, giving $1000 in cash and nine notes for $1000 each. After $3000 had been paid, Mr. Ridgely decided to inspect the property and took along some mining engineers who reported that while traces of gold were found occasionally, the property as a whole did not have the value represented. The title, Mr. Ridgely says, was encumbered by previous contracts and he claims that in all he spent about $7000 before he found that he had been defrauded. Against Allen's suit to collect on the notes, Mr. Ridgely seeks to collect the $7000 expended in proving the property and the $3000 he paid for stock. In his answer to the counter claim, Mr. Allen naïvely says that he isn't a mining engineer either, and that the representations he made to Mr. Ridgely had been made to him previously and that he believed them to be true. The moral being that managing the coin of the realm is one thing, digging it another.

The investigation of the labor conditions at the mines and plants of the United States Steel Corporation, suggested last year by Charles M. Cabot, of Boston, did not reveal any serious abuses as had been intimated in the yellow journals. Mr. Cabot, however, will probably continue his agitation of the matter, but, with or without this agitation we shall all probably see the abolition of the 12-hr. day. As a matter of fact there are very few mines or metallurgical plants in this country today where the 12-hr. shift is worked. In a competitive industry like that of steel, it is impracticable for one company, even though it be the largest in the industry, to make a drastic change in the hours of labor without the cooperation of its competitors. The 12-hr. day is a relic of ancient agricultural conditions, and has no place in modern industry at least not in this country. It gives time to eat, sleep and work; any other entertainment—except on "long-change" day—means robbing one's sleep. Modern industry maintains that it has increased the productive abilities of the individual and it should and will provide correspondingly increased hours of leisure. There are, however, instances here and there of the old system. One of the best we have heard recently was the case of the new farm hand on a North Dakota farm. When the farmer awakened the new hand at 3 a.m. he said, "You can get up now and go down to the oat field east of the barn and cut them oats. By the time you've finished, breakfast will be ready." "Are they wild oats?" inquired the new hand. "Wild? why no, they're tame oats." "Well, if they are tame oats, maybe I can slip up on 'em in daylight."

Miami Copper Co.

The report of the Miami Copper Co., operating in the Globe district of Arizona, for the year ended Dec. 31, 1911, shows a total of 445,036 tons of 2.48% Cu ore milled, and 20,065 tons of 40.36% concentrates produced, equivalent to 36.39 lb. of copper per ton of ore, or 73.37% mill extraction. From the concentrates were produced 15,385,783 lb. of fine copper. The cost of copper on board cars at Miami is shown in the accompanying table.

COSTS AT MIAMI, 1911

	Per Ton Ore	Per Lb. Cu.
Mining	$1.2134	$0.03500
Milling	0.6274	0.01810
General	0.1706	0.00492
	$2.0114	$0.05802

In order to protect the ore from admixture with waste, and to permit complete extraction of ore without leaving pillars behind, it was found necessary to mine the outer ore by square sets and slicing so as to protect the central mass by a mat of timber. As this outer ore contains oxidized copper which cannot be efficiently saved in milling, the extraction obtained is not considered as good as will be had later. Similarly, the cost of mining, $1.21 per ton, is not considered as good as will be attained after the top layer of ore is removed by the caving system.

Ore hoisted during the year amounted to 450,036 tons, derived as follows: Stock pile, 43,437 tons; mine development, 152,074; square-set and sub-level caving, 204,362; shrinkage-stope rooms, 50,163 tons. Before starting the mill, during 1911, 18,771 tons of ore were added to the stock pile, and at the end of the year there were 226,343 tons in the stock pile, and 5000 tons in the bins. The capping has already begun to cave over the ground extracted by square-set timbering.

The mill was started on Mar. 15, 1911, with one section, at the end of the year five sections were running, milling 2500 tons per day, and the equipment of the sixth section was complete except for the fine-grinding machinery.

During the year 22,888 ft. of drifts and 10,047 ft. of raises were driven. The work consisted chiefly of completing the 420-ft. tramming level and opening up the ground in the northwest portion of the orebody, the limits of which had been defined by churn drilling. Ore reserves are estimated at 18,232,000 tons, averaging 2.58% copper. Drilling has been discontinued except on the Red Spring claim, where new ore of commercial grade has been found.

Additional power-plant equipment is being provided for the increased tonnage of ore to be handled over the original estimates. A third 1000-kw. electric generator, a second air compressor of 4000 cu.ft. capacity, and a spare condenser are installed. The water supply consists of 2,000,000 gal. per day from the Old Dominion mine, while it is expected to draw from 500,000 to 1,000,000 gal. per day from driven wells.

Beside the expense, exclusive of general mining expense, of putting the concentrates on board cars at Miami, which on the 14,970,557 lb. of copper already sold is taken at 5.310c. per lb. copper, other expenses are shown as follows: General mining expense, 0.714; freight on concentrates, 0.629; smelting, refining and freight on pig copper, 2.326; selling expense (including freight and insurance on refined copper), 0.171; New York office expenses, 0.175; total, 9.325c. per lb., from which must be deducted 0.222c. for proceeds of silver and miscellaneous rentals, leaving a net charge of 9.103c. per lb. The copper sold at 13.03c. per pound.

BALANCE SHEET OF MIAMI COPPER CO., DEC. 31, 1911

Assets

Mine property		$1,626,133.22
Development		1,285,420.64
Construction:		
Concentrator	$1,516,488.91	
Power plant	629,432.93	
Miscellaneous equipment	5,451.54	
Mine buildings and improvement	70,228.09	
Dwelling houses	115,815.01	
Water development and pumping station	350,215.52	
Shaft No. 4 equipment	120,550.89	
		2,808,182.89
Ore on hand (at estimated cost of mining)		232,410.11
Metals on hand less advances		395,772.52
Sundry materials and supplies		182,389.78
Unexpired insurance		1,202.83
Stock investment		20,459.05
Cash		85,670.68
Accounts receivable		4,028.14
		$6,641,669.86

Liabilities

Capital stock:		
Issued 664,993 shares at $5		$3,324,965.00
Bonds, 10-yr., 6% convertible		1,415,000.00
Capital surplus:		
Premium on shares, less expense of issue		1,009,999.98
Accounts payable:		
Pay roll and sundry bills	$90,048.80	
Smelting and freight charges not due	189,552.47	
Machinery and supplies	66,704.47	
Reserve for bullion tax	16,875.43	
		363,181.17
Profit and loss account:		
Balance Jan. 1, 1911	$38,920.33	
Transfer from profit and loss account for 1911	489,603.38	
		528,523.71
		$6,641,669.86

As to finances, a condensed balance sheet is here given. The bonded indebtedness was reduced $18,000 in 1911 by conversion of bonds. While the cost of development has been debited to capital, development account has been credited with 31c. per ton of ore hoisted, which, if continued, is estimated to be sufficient to liquidate fully all past and future development costs.

Amber in Russia

Owing to the exhaustion of the amber deposits of Western Europe, recent investigations by Belgian engineers acquire great importance, says the *Russian Universal Technical Review*. The most important deposits seem to be in the Volhynia and Minsk governments, where it is widely distributed near Dombrovitsa in the Roona district, at Goryni, and near the village of Barashi in the Zhitomir district.

Prospects of Copper

At the recent annual meeting of the Rio Tinto Co., in London, Charles W. Fielding, chairman of the company, made the following statements regarding present copper conditions: "Regarding the future of copper, I will only say a few words, but these are very hopeful ones. The enormous stock of copper, which was accumulating during 1908 and 1909, reached its maximum in the middle of 1910, since which date the copper stocks of the world have been gradually decreasing, and today they are less than half of what they were 18 months ago. We can only conclude from this that such low prices as prevailed in 1910 and 1911 were unremunerative to a good many mine operators, and this, among other causes, makes us confident that in the years that are coming we are justified in hoping for copper values which will enable us to earn enhanced profits. The prospects, therefore, in regard to copper are very much better than when I had the pleasure of addressing you 12 months ago, and, while we do not think your interests would be best served if copper was ruling for a long period at an excessively high price, yet we feel sure that there is room for an additional rise in the price of copper before it will in any way restrict consumption, while the cost of producing copper at many mines would need considerably higher prices than those ruling in recent years to enable them to pay reasonable dividends to their shareholders and at the same time have any chance of amortizing their capital during the life of their orebodies."

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Where Should the Primer Go?

In reading Mr. Brown's article in the JOURNAL of Apr. 6, 1912, on the question of where should the primer go, there were two or three things which drew my attention. Mr. Brown said the custom of placing the primer near the bottom of the hole is practically universal among those miners engaged in machine drilling. That sounds strange to me. Of course, that is Mr. Brown's experience, and it may have been as wide as mine; but mine has been just the reverse of his in that respect.

I have had over 30 years' experience with machine drilling, and in 99 holes out of 100 the primer is the last stick that is put in the hole. I have worked as a miner for 20 years, and during that time I have put in thousands of primers but have never thought of putting the primer in the hole until the last; that is the practice in the Lake copper district. However, I do not think that powder burns in the hole sometimes because the primer is placed in the bottom of the hole. I believe there may be three other causes: The cap is not strong enough; the powder is inferior; or the powder is frozen.

I was much surprised when I read the amount of powder placed in the hole, instanced by Mr. Brown; that is, providing the sticks were of ordinary length, eight inches. I know some rock requires more powder than another, but I never knew of any rock that required more than these copper formations. In places where the lode is rich in either amygdaloid or conglomerate the native copper makes it difficult to break, but in such cases the hole is seldom more than half filled with powder, and ordinarily a six-foot hole would have no more than four or five sticks of 40 or 50% explosives. A hole that is overcharged does not break as well as one that is not so full.

Some figures on some work now being done in this district may be of interest. The rock, I believe, is a little stronger than the average to be found around here. We are sinking a 7x19-ft. shaft, which we are not crowding, but working as it should be worked. The mining is done on the day shift and the mucking at night. We have two of the best drills on the market and have two men on each drill. Each drill puts in about 40 ft. per shift, or six holes from six to seven feet deep each. It requires about 30 holes to take a sink and square in. We do not drill all of these holes before blasting, but blast on each shift, for by so doing we do better work. With two of these drills, 5½ shifts a week, we get from 60 to 65 holes drilled and make about 13 ft. per week. We used about four boxes of powder with 85 to 96 sticks in a box, an average of about 5½ sticks per hole, of 50% explosive.

JOSEPH HOSKING.

Osceola, Mich., April 5, 1912.

Inasmuch as I started the present discussion on the above topic, I trust I may be allowed a word in summing up now that a du Pont man has kindly entered the lists.

Mr. Gunsolus says (ENG. AND MIN. JOURN., Mar. 30, 1912): "As a rule, with the exception as noted, the primer cartridge should be placed in the bore hole last, or next to last, whether fuse and blasting cap are used or the charge is detonated by electric fuses." The exception noted is that some Colorado miners "use the method of placing the primer cartridge in the bottom of the bore hole" to avoid liability of the collar of the hole being knocked off and the primer, if on top, being thrown out, causing a missed hole. He says that gelatin dynamites are less liable to be deflagrated by side-spitting of the fuse and that it was in the use of gelatin that Mr. Anderson (ENG. AND MIN. JOURN., Feb. 3, 1912) recommended the use of the primer at the bottom of the hole. Therefore, my original query is answered.

The discussion, though interesting, has tended toward the acrimonious. Mr. Semple (ENG. AND MIN. JOURN., Mar. 2, 1912) says that the proper place for the primer, if electrically detonated, is at the bottom of the hole; Mr. Gunsolus says at the top. Mr. Semple says that when using ordinary fuse, "there is but one place for the primer, the top." Mr. Gunsolus would seem to agree with this rule. Mr. Brown says (ENG. AND MIN. JOURN., Mar. 16, 1912) "that is generally the worst possible place for it," using the knocking off of the collar as his argument in proof. Mr. Brown is evidently describing Colorado practice, which is specifically noted by both Mr. Gunsolus and Mr. Anderson as "Colorado practice," and it would seem from the present disputants, at least, that only a Colorado man upholds the practice.

We certainly cannot admit Mr. Brown's dictum that "The custom of placing the primer near the bottom of the hole is practically universal among those miners engaged in machine drilling," nor can I admit the finality of his argument that the holes must have been properly loaded because done by a "practical and experienced miner." Some of us who have mined less in Colorado, but more in the various other Western states, might contest the first assertion, and the practical and experienced miner often has a lot of theories that cost his company money, and one of his pet ones is about loading a hole.

There is one point against having the primer in the bottom which has not been brought out; that is, the very kick away from the bottom of the hole has a tendency to kick out of the hole some of the charge, especially in the poorly tamped holes that most miners consider sufficient. As for knocking off the collar and tearing out the primer, thus causing a misfire, I believe this would be almost irrefutable evidence that either the hole itself or the one that shot its collar off was too heavily loaded or was misplaced. Certainly the collar of a hole is no place for dynamite.

Perhaps the opinion of an expert in Mr. Gunsolus' position ought to be final, and it is, therefore, not without some feeling of temerity that I close with my humble opinion on this topic. T. A. Rickard says there is only one rule without an exception, and that is that "a man must be present when he is shaved." The French have a maxim, "There is no general rule, not even this one." Yet a Yankee is nothing if not positive, and I am convinced, as a result of experience, careful observation and diligent study, that the primer cartridge should always be placed last in drill holes, and wherever there is a valid argument against putting it there, there is a still stronger argument for doing so.

PERCY E. BARBOUR.

Candor, N. C., Apr. 8, 1912.

Mining Codes

Will you allow me space in the Discussion column to call the attention of mining engineers to the fact that the 1908 Bedford-McNeill code is entirely different from the early issues, and that I think engineers should state on their letter heads and in their advertisements the date as well as the name of the code being used. What is the reason for this change? Is it merely to allow the code companies to sell new codes to all the old users? Anyone who has tried to decode a cable message by the wrong code will fully endorse this suggestion.

R. A. BURR.

New York, Apr. 16, 1912.

Safety Appliances in Inclines

In regard to the subject of preventing accidents from runaway cages or skips in inclines, which Mr. Ives brought up some time ago, prevention against such accidents is provided at the Gagnon incline, at Butte, Mont., in exactly the same way that such occurrences are guarded against in hoisting with cages in vertical shafts.

The Gagnon incline has a dip, I believe, of about 70°. In it skips having a capacity of 2½ tons are used, while the men are hoisted through it on cages that are taken off and put on at the proper times. Riding during shift is on the skip itself, instead of on a top deck, as is characteristic of the practice in the vertical shafts, at Butte. The shaft is timbered with sets, and on these sets guide timbers are carried just as in the case of a vertical shaft. This close timbering is necessary, owing to the heavy ground that compels close timbering of vertical or incline shafts in the Butte district. Probably that is one reason that the safety catches were put on the cages and the skips at the Gagnon incline. The adding of the guide timbers was a small item of expense. Safety dogs of the cam pattern that is characteristic of cage construction in this country are provided on both the skips and the cages. These are operated by springs that are released by the relief of the pull on the draw-bar just as in the case of the cages and skips running in the vertical shafts. Farther explanations are unnecessary.

In regard to the protection against runaways in incline shafts that are not closely timbered, the most feasible solution appears to be the use of cam-shaped shoes, or, better, knife-like dogs to be thrown out either to grip, in the case of shoes, or to groove, in the case of dogs, the stringer on which the rails of the track are carried. I believe that a device operating on this principle, was designed by Charles Mason, for use on the inclines at the Baltic mine of the Copper Range Co., in Michigan, but it was never made. It is purely a matter of expense. There is no mechanical reason why dogs cannot be made that will stop the cage by coming in contact with the inside faces, or, for that matter, the outside faces of the rail stringers, only that the latter would require additional shaft area. In the case of the concrete stringers a timber would probably have to be imbedded in the side of the stringer for the dogs to groove; for the safety dog to work effectively should work on the grooving principle instead of the gripping principle that is used in most safety catches in the United States. A gripping dog comes on suddenly. It tries to grip and fails, if things be not just right; then tries again, the velocity of the cage increasing all the time. Finally the teeth of the cam catch and the guide is suddenly gripped, with the result that several sets of guides are torn out. On the other hand, with a knife- or a chisel-edge to the dog, grooving begins as soon as the dog comes in contact with the guide. This groove is rapidly but gradually deepened, with the result that the energy of the falling cage is gradually diminished, and the cage is quickly stopped before it has fallen any great distance—generally less than 8 ft. in the shafts where dogs working on this principle are used.

In the case of the safety dogs for use on inclines, it it necessary to arrange them as to shape, so that they will straddle the roller frames. This, though, is no great difficulty to overcome.

The matter of providing against runaways in inclines is simply a question of dollars and cents. It requires the installation of special apparatus at considerable expense. The mine manager would rather take the chances with runaways in his shaft than do this. Specially constructed stringers, securely anchored in place, would have to be used. No one as yet has seen fit to go to this expense, and therefore it is considered good practice in incline shafts not to use safety appliances on skips and man cars operating on inclines. On the other hand, safety dogs can be installed on cages and skips in vertical shafts with small expense, and so it early became the practice to put on the dogs, as the guides have to be there whether dogs are used or not. No one has the nerve or the niggardliness to leave them off when he thinks much of his reputation among mining men.

The same might also become characteristic of hoisting in inclines with the stringers for carrying the rails to serve as the pieces to be grooved in stopping the skip or man-car, were inclines characteristic of the mining practice in those Western states where the miners themselves have a chance to say something in the making of the laws under which mining shall be carried along. As it is, incline shafts are characteristic of districts where the companies have the say in the making of the laws under which the companies operate, or else, as in the case of California, the unions have only recently come into a position to have anything to say as to the mining laws in the state.

There is yet to be shown a single state where there is adequate provision in the laws for the safe operation of mines, unless directly or indirectly it was forced there by the unions or the desire to keep out union agitation, as in the case of Idaho, which, I believe, finally adopted the admirable set of laws proposed by R. N. Bell, when state mine inspector, which he, for several years, tried in vain to have enacted as laws.

It is a disgrace to the mining profession that the Gagnon incline is, I believe, the only incline in the United States, and probably the only one in the world, where safety appliances for catching a runaway cage or skip are used in an inclined shaft.

Further, I doubt if there is a single hoisting engine in the United States working in an inclined shaft that has any provision against overwind, any rope detaching device, or an automatic cutoff for the steam as the car approaches the surface, that are characteristic of good hoisting practice in vertical shafts, because they all cost money.

CLAUDE T. RICE.

Flat River, Mo., Apr. 16, 1912.

A New Type of Gravity Plane

Mr. Smith's description of inclined planes in which the descending cars always move on one track and the ascending on the other, and in which, consequently, the tracks at the head of the plane can always have a slope in favor of the load and need no special arrangement to get the descending cars over the knuckle, will call attention to an excellent arrangement which seems, somehow, to have been generally overlooked. The plan was fully described, as applied to underground planes at Commentry, in an article by M. Comblat in *Comptes-Rendus Mensuel de l' Industrie Minerale,* 1896, p. 81, under the title: *Note sur le croisement des câbles dans les plans inclinés.* I have seen no other account.

At my suggestion a plane on Mr. Comblats plan was built at Cranberry, N. C., in 1904. It worked well and is still in use, I think.

For underground planes, to save room, Mr. Comblat recommends placing the brake-sheaves in a vertical position in the center line of the plane. As thus arranged the ropes are not crossed, but there is more or less sidewise pull on the cars on the upper half of the plane.

J. E. Johnson, Jr., applied a sheave in a reversible frame to cross the ropes at an outside plane at the mines at Glen Wilton, Va., several years ago. I have never seen this plane and do not know how nearly this frame resembled Mr. Smith's well studied design.

F. FIRMSTONE.

Easton, Penn., Apr. 13, 1912.

Nickel in the Zinc Assay

Does the presence of nickel affect the assay for zinc?

A. G. S.

[It is our experience that nickel affects the ferrocyanide assay for zinc seriously, making the apparent zinc content higher by an amount practically equal to the nickel present. As a consequence, it is necessary at some point in the assay to precipitate the zinc and nickel as sulphides and dissolve out the zinc sulphide with hydrochloric acid.—EDITOR.]

H. Forbes Julian

H. Forbes Julian, who was lost on the "Titanic," was a well known metallurgical engineer, a specialist in gold-ore treatment. He was a resident of Torquay, England, and was one of the authors of the valuable work, "Cyaniding Gold and Silver Ores." He was a pioneer in the South African goldfields, where, in 1887, he was one of the consulting engineers to the Johannesburg Pioneer Co., and erected a small plant to treat blanketings from the company's first stamp mill, by the cyanide process. This was the first cyanide mill in the Transvaal. In 1888 he erected a better plant at the Roodepoort United Main Reef mill, and successfully treated low-grade ores by the cyanide process, then in its infancy. About the same time he was making investigations in connection with the dissolution of gold ores by chlorine and also by cyanide under a high pressure of air, and subsequent precipitation by an electric current and by sodium amalgam, which resulted in some patent applications in South Africa. He was on his way to San Francisco to take up some special work in connection with the Butters Patent Vacuum Filter Co., Inc., with which he had been connected for some time.

Benjamin Guggenheim

Benjamin Guggenheim, who went down with the "Titanic," was born in Philadelphia in 1865, being one of the younger of the seven sons of Meyer Guggenheim, who have become so prominent in the mining and metallurgical industries. In the early '80s, Meyer Guggenheim became a part owner of the A. Y. & Minnie mine at Leadville, Colo., which turned out to be profitable, and in 1885 Benjamin, just out of school, was sent to it to begin his business career and to look after the interests of his father, being given a position in the office. During this period he became acquainted with general mining and smelting conditions, especially from the commercial standpoint, and in 1888 was interested by Edward Holden in the smelting business, and in turn interested his father and brothers in Philadelphia. This was the inception of the Philadelphia Smelting & Refining Co., which erected works at Pueblo, Colo. In a very short time the business passed wholly into the hands of the Guggenheim family, several members of which were sent to Pueblo to learn it. For two or three years the works were not very successful, but before long all of the difficulties were cured and the brilliant commercial career in this business, with which all are familiar, was inaugurated. The great success began in 1892, when the importation of Mexican lead ore having been checked by the McKinley tariff, the Guggenheims immediately appreciated the possibilities of smelting in Mexico and erected a plant at Monterey, which was later followed by one at Aguascalientes. Later a refining plant was erected at Perth Amboy, N. J., under Benjamin Guggenheim's superintendence. After the smelting interests were consolidated he retired from active work for a time, passing two years in Europe. Returning to this country, he entered into the mining-machinery business in 1903, organizing the Power & Mining Machinery Co., which built large works at Milwaukee. In 1906 this concern was merged with the International Steam Pump Co., in which Benjamin Guggenheim was successively a director, chairman of the executive committee and president. This continued his chief business interest, and the visit to Europe, from which he was returning, was made for the purpose of inspecting and extending the work done through its foreign agencies.

Ernst A. Sjostedt

Ernst A. Sjostedt, one of the victims of the "Titanic" disaster, was chief metallurgist of the Lake Superior Corporation, of Sault Ste. Marie, Ont., and was returning from a three months' visit to Europe in connection with the business of the company. Mr. Sjostedt was born in Sweden in 1852 and was a graduate of the Stockholm School of Mines. He came to America in 1876 and was engaged at the Bethlehem steel works and afterward became manager of several iron plants in the United States. For some years he was in business in Montreal as a consulting metallurgist, and in 1898 went to Sault Ste. Marie as an associate of F. H. Clergue in the establishment of the group of enterprises subsequently taken over by the Lake Superior Corporation, one of the most important of which was the manufacture of ferro-nickel steel. He built the reduction works and the water-gas plant at the Sault, and was recognized as one of the leading metallurgical authorities in Canada. He leaves a widow and one daughter.

George D. Wick

George D. Wick, of Youngstown, Ohio, was one of the passengers lost in the wreck of the "Titanic." He had been connected with the iron interests of the Mahoning Valley all his active life, succeeding his father, who was a well known iron master. Col. Wick was vice-president of the Union Iron & Steel Co., Youngstown, when it was sold to the National Steel Co., now part of the Carnegie Steel Co.'s works. He then became vice-president of the Republic Iron & Steel Co., with offices in Chicago, but after one year with James A. Campbell he founded the Youngstown Sheet & Tube Co., at Youngstown. Because of ill health he retired from the presidency of that company. Later he purchased control of the Carry Iron & Steel Co., at Cleveland, and about a year ago merged it with the Empire Iron & Steel Co., of Niles, Ohio. On the formation recently of the Brier Hill Steel Co., he sold out his interestss in the Empire company.

Edgar J. Meyer

Edgar J. Meyer, vice-president of the Braden Copper Co., and an engineer of ability and experience, was one of those who went down on the "Titanic." We hope later to publish an extended notice of his life.

Florence-Goldfield Mining Co.

The report of the Florence-Goldfield Mining Co. for the year ended Dec. 31, 1911, shows that the amount of development work accomplished was 11,699 ft. at a cost of $7.281 per foot.

The work above the 530-ft. level disclosed the fact that the lessees had stoped practically all the ore of shipping grade, but two orebodies of good milling grade are still being developed at present. Development below this level, up to this time, has shown no ore of commercial grade. However, the change of geological conditions at 950 ft., where the main shaft enters the dacite, is considered by H. B. Clapp, mine engineer, to be much more favorable for discovery of ore at depth, the productive orebodies to the north being in the dacite and latite flows.

During the year, 48,847 dry tons, averaging $6.10 per ton in gold, were treated in the mill, an extraction of 83.96% being obtained. In this period no concentrates were made, as by certain changes in operation the above extraction was accomplished by amalgamation and cyanidation. This not only resulted in lower operating costs but also eliminated the cost of freight and smelting charges on concentrates, which in 1910 cost the company $44,457. General Superintendent Dewey states that this saving more than offsets any slight loss that might have occurred from eliminating concentration.

The costs are given as follows: Mining, $1.242; development, $1.744; milling, $2.595; marketing, $0.047; general expense, $0.381; taxes, $0.080; total, $6.089 per ton.

On the evening of Dec. 2, a fire of unknown origin totally destroyed the mill and storehouse, together with the gallows frame at the main shaft and the timbering of the shaft to a depth of 35 ft. After deducting insurance of $83,500 the loss is reported as $212,481. All efforts are being exerted in developing and determining the extent and value of the orebodies before again building a mill

Yerington District, Nevada

SPECIAL CORRESPONDENCE

The Yerington copper district, in Nevada, has taken on new life during the last few months. Work is being prosecuted on nearly all the prospects which show indication of being able to ship at least some ore; the larger properties are rushing development work and daily shipments are being made from the Nevada-Douglas Copper Co.'s mines, Mason Valley Mining Co.'s properties and the McConnell mine, as follows: From the Nevada-Douglas mine, 350 tons of 5½% copper ore per day; from the Mason Valley mines, between 350 and 375 tons per day, of approximately 4% copper ore, and from the McConnell, an average of 60 tons per day, of ore which contains 5% copper. Leasers are shipping an occasional car from the numerous open pits of the Empire Nevada property.

THE NEVADA-DOUGLAS

The Nevada-Douglas Copper Co. is also shipping approximately 500 tons of crushed gypsum per week, to the plant of the Western Gypsum Co., at Reno, Nev. During the last month, a crushing plant has been installed at the gypsum quarry, where the rock, as it is taken from the quarry, is crushed to 3-in. size through an Ersham crusher and elevated in a bucket elevator to bins which load directly into cars. The equipment is electrically driven. The company is finding its new electric hoist entirely satisfactory and has installed and is now working a 50-hp. Gould triplex pump on the seventh level of the Ludwig mine. Development work is being rapidly extended on this level on the east and west veins. Chalcocite ore has been encountered and now forms a fair proportion of the shipments. Both faces of the south drifts on these two veins are advancing at the rate of 125 ft. per month. The drifts are large and are being laid with 16-lb. steel. No water is being encountered in these workings, aside from a small flow of 50 gal., struck near the shaft. Development work on the sixth level is also being advanced rapidly and at the south end of the sixth level, at a point approximately 700 ft. south of the incline shaft, a 2-compartment winze is being sunk to the seventh level. This winze is in good-grade ore and is being driven near the hanging wall of the vein, at the end of a 96-ft. crosscut, through mixed gossan, sulphide material. For the first 500 ft. this level was in sulphides, but the water level has been depressed so that, strictly speaking, this level is in the oxidized zone at the south end.

THE MCCONNELL MINE

The McConnell mine is shipping a sulphide and carbonate impregnated, garnetiferous lime from the old workings, most of the ore coming from near the surface. The work is in charge of O. H. Sonne and Samuel B. Elbert, owners. They are working a force of from 25 to 35 men, keeping development work ahead of extraction. They have a reasonable contract with the Mason Valley Mines Co.'s smeltery, at Thompson, 18 miles distant, and a low rate over the Nevada Copper Belt R.R. to that point. The ore is hauled by teams about 3½ miles down hill, over good roads to an elevated platform or bridge extending over the cars. The Mason Valley Mines Co. ships from its property to the smeltery, limestone and oxidized ores low in silica and sulphides. This ore is handled from the main chutes by electric locomotives and crushed and sent down to the railroad over an 8000-ft. bucket-tram line. There have been rumors of one of the large mines of this district taking over the Bluestone mine, but no transaction of this nature has been consummated to date.

MASON VALLEY SMELTERY

The Mason Valley Mines Co.'s smeltery is running along smoothly, and is obtaining excellent results with low costs. The second furnace has not been blown in yet. The single furnace has smelted as high as 706 tons in 24 hours, but the furnace can run regularly on between 500 and 600 tons per 24 hours. This is satisfactory, considering the fact that the plant was built as an 800-ton smeltery, with both furnaces running continuously. A 40% matte is being produced. Considerable custom ore is being received from the Southern Nevada districts and satisfaction has been obtained by all who have thus far shipped. The Yerington Copper Co. is working a small force of men and adjoining properties have commenced operation. At Buckskin, the Kennedy Consolidated has recently completed its surface plant and is sinking and drifting. This property has attained a depth of 150 ft. and has exposed some good copper sulphides.

U. S. Smelting Co. in Utah Coal Fields

The United States Smelting, Refining & Mining Co. has acquired control of the Castle Valley Coal Co., Black Hawk Coal Co., and Consolidated Fuel Co., which own 11,226 acres of land in Utah, of which 7526 acres are coal lands. There are five seams of coal on this area. The lowest seam averages 16 ft., and development work has hitherto been confined almost entirely to this seam, which is estimated to contain 140,000,000 tons of mineable coal. The next higher seam is 12 ft. thick.

The fields are connected with the Denver & Rio Grande R.R. by a 23-mile line owned by the coal companies, but an 80-mile connection reaching the Union Pacific R.R. at Spanish Fork, via Huntington Cañon, will also be put in, as the Union Pacific reaches a wider market than does the Rio Grande.

These fields are now shipping 500,000 tons of coal per year, which sells at about $2 per ton at the mines, but the attempt will be made to bring these properties up to annual production of 2,000,000 or 3,000,000 tons in the near future.

As noted in the JOURNAL of Apr. 20, 1912, p. 813, these properties are to be worked by the Utah Co., a Maine corporation, the stock of which will all be held by the United States Smelting, Refining & Mining Company.

California Oil Producers' Agency

SAN FRANCISCO CORRESPONDENCE

The first formal report made by the president of the California Oil Producers' Agency was submitted to the stockholders at a meeting in Bakersfield, on Apr. 10. The report showed that the agency had received from its members during the year past 15,000,388 bbl. of oil, and that 14,004,102 bbl. were sold at a price which netted 31.97c. per bbl. Practically all of the old contracts which will expire within a short time it is believed will be renewed at a rate which will give to the producers a higher net price than the price of the last year. There were 81 members in person and by proxy at the stockholders' meeting. Upon motion of M. L. Requa, 68 members of the old board of directors were reëlected. It was announced that the certificates for storage oil would be ready for distribution Apr. 20. L. P. St. Clair was reëlected president, this being his sixth term. The financial statement for the year ended Mar. 31, showed receipts and disbursements of $3,994,074. The total income for the year was $71,664. The total operating expenses and charges on account of depreciation was $58,113, leaving a net income for the year, $13,550. The cost for handling was $0.003706 per barrel.

The president's report showed contracts for the sale of oil to consumers, a total of 52,288,722 bbl. The actual requirements will probably reach 60%, or 31,373,233 bbl. Approximately 25% of this requirement will expire during the year 1912, and 70% during 1913. With renewals at better prices, the average net price to the producers will be materially increased. It is pointed out in the report that the discontinuance of storage charges under the proposed plan to certificate storage oil will also increase the net returns to the producers. This charge amounted to 3.93c. per bbl., or a total of $462,842 in 1911. There is a general feeling among oil men that there will be an advance in the price of oil at the well, and that the commercial consumption will increase. This condition, in addition to

the progress being made in handling the water infiltration, has given the petroleum industry a very hopeful look, and the excess stocks are not at present such a bugbear as they were considered a year ago.

Mining in Rhodesia

JOHANNESBURG CORRESPONDENCE

The chairman of the Rhodesian Chamber of Mines has recently stated that the value of the ore reserves of 6,700,000 tons fully developed in the large mines of the country is £13,000,000, or sufficient to maintain the present output for five years. This is not including ore in the small mines, which at present contribute 25% of the output. This is satisfactory, but in some respects the outlook is not entirely encouraging.

SOME MINES DISAPPOINTING AT DEPTH

The Globe & Phœnix mine, which has paid nearly £1,000,000 in dividends and which has ore to the value of £1,300,000 developed, is not looking well in depth, the remarkable enrichment about the 17th level having apparently been bottomed. The Giant mine, another mainstay, is absolutely bottomed and is now exhausting its developed ore, and several other steady producers in the past have closed down or passed into the hands of tributors.

Several of the newer mines developed during the boom period are not coming up to expectations, so that the new and promising ventures will have to maintain rather than increase the output. Of the new mines the Shamva is now meeting with profitable ore on its third adit level 500 ft. below the outcrop and below the zone of oxidation with some secondary enrichment.

The Cam & Motor mine shows a lens of ore 100 ft. wide at the fifth level, of an average value of 40s. per ton. The Lonely mine continues to develop rich ore to the eighth level, though the treatment plant has never reached the estimated output of 4000 tons per month. This is due to shortage of labor and fuel, caused by cattle disease, which disorganized transport, and to the need of alterations to the boilers and additions to filter presses and tube mills.

Most of the lenses of ore met with in Rhodesian quartz reefs are from 30 to 100 ft. in length, frequently limited in depth and are not often numerous enough along a line of fissuring to warrant comprehensive development. Practically all gold-bearing outcrops were worked by the ancients to varying depths, but fortunately considerable quantities of lower-grade ore were left broken on the surface (Rhodesians term this rubble).

From 1904 on the small worker was in a particularly favorable position. The larger corporations formed when the country was first occupied had partially developed many old workings, and in some cases had equipped mines which they were unable to make pay with costs and methods then ruling. These were handed over to tributors who thus had much ore available and were able to make a large aggregate output and to make large profits. Central mills of 3 to 10 stamps were also erected to draw supplies from rubble deposits and old workings or short shoots, or portable Tremain mills were carted about.

It says much for the number of gold occurrences that these superficial mining operations have lasted for eight years, but at present nearly all the rubble deposits, which included float rock and detritus from outcrops, are exhausted and practically all of the ancient workings have been opened and are almost exhausted. In many districts the small worker is rapidly becoming extinct, and it is increasingly difficult to obtain a property that would in any way warrant development and the erection of a mill.

FAVORABLE PROSPECTING CONDITIONS

Much is expected by some from the discovery of virgin reefs and no doubt undiscovered orebodies do exist. Most orebodies, however, occur in a matrix of quartz and in the undulating and hilly country of most of the gold belts (which are schistose areas in the granite) the overburden is not heavy and a quartz reef usually appears or shows float rock at some point along its line of strike, so that these outcrops have mostly been tested by the ancient or modern prospector. There are indeed areas covered with overburden such as the Eiffel flats in the rich Gatooma district, in which valuable discoveries have been made, but the expense of prospecting unknown country by sinking pits and trenching is at present prohibitive.

Were agricultural operations to become extensive no doubt more chance discoveries would be made, but the impression given was that by far the greater bulk of the ore deposits are already found and worked and that the contribution by the small worker is bound to become smaller year by year. The Rhodesian small worker is a fine type of efficient worker who with the aid of his native laborers can attack exceedingly poor ore if there be wood and water available. A mine with a five-stamp mill run entirely by two or three white men can win fine profits from 20s. rock occurring in a reef of a stoping width; with a 10-stamp mill a small worker would not neglect a reef giving a return of 16s. per ton.

The Shamva mine owners hope to mine their large ore deposits in the Shamva hill and to crush in a 100-stamp mill for about 8s. per ton. The Wanderer mine at Selukwe has worked its opencut orebody at a still lower cost. It will be at once evident that little low-grade ore is being left for posterity and that Rhodesia is not going to deluge the world with that flood of gold which some so-called economists blame for all the ills of recent years and the perfectly natural rise in prices due to greater demand and reduced supply of most raw materials.

Duty on Manganese and Ferromaganese

WASHINGTON CORRESPONDENCE

The Court of Customs Appeals has rendered a decision in the case of the Goldschmidt Thermit Co. *vs.* the United States in which it affirms the decision of the Board of General Appraisers making manganese dutiable at 20%. The merchandise involved in this case was imported under the tariff act of 1909; it consists of an alloy of iron and manganese. The importers invoiced the article as ferromanganese, and claimed assessment under that name at $2.50 per ton, according to the provisions of paragraph 118. The appraiser reported that the importation was commercially pure manganese metal, and upon this return the collector classified the same as metal unwrought, not specally provided for, dutiable at 20 per cent. *ad valorem* under paragraph 183 of the act.

The importers duly filed their protest, which was heard upon evidence by the Board of General Appraisers, and was overruled.

The single question at issue in the case is whether the importation is ferromanganese, dutiable at $2.50 per ton, or unwrought metal, not specially provided for, dutiable at 20 per cent. *ad valorem.*

At the hearing before the board the importers introduced evidence of a chemical analysis of the article, made at their instance, which gave the following contents: Manganese 93.92, silicon 1.56, iron 2.33, aluminum 1.58, carbon 0.10, unstated residue 0.51. On the other hand the government produced testimony of a chemical analysis made by the official chemist, which gave the following result, viz., manganese 96.80, iron 1.40, silicon 1.40, undetermined, carbon, etc., 0.40. The government also submitted evidence tending to prove that the term ferromanganese has a commercial signification which excludes any alloy having so high a percentage of manganese as that at bar. The importers on the other hand submitted no testimony in regard to commercial designation.

In rendering its verdict the court says:

"It seems clear from the definitions and the testimony in the case that the use which fixed and determined the meaning of the term ferromanganese was its use in the making of bessemer steel, and that this use is most effectively and economically subserved by an alloy containing about 80 per cent. manganese with approximately 5 per cent. carbon, and the

residue iron. Such an alloy, therefore, became the standard, and the use of the term ferromanganese, without qualification, properly applied to this standard. It is, therefore, reasonable to believe that the word was used substantially in that sense in the tariff act, and this belief is strengthened by the fact that it is there found collocated with iron in pigs, iron kentledge, and spiegeleisen.

"The importation in this case contains a much greater percentage of manganese than that above indicated as the common standard, and a much less percentage of iron, while carbon hardly appears as a substantial component. . . . . It appears that manganese does not figure in commerce in a chemically pure form, but always in combination with other elements; and foreign additions so slight as those stated in the analyses are correctly regarded as mere incidental impurities. Such an article is therefore manganese, and not ferromanganese.

"In this view of the case the assessment made by the collector was correct, and the decision of the board sustaining the same is affirmed."

Steel Production in 1911

The American Iron & Steel Association reports that the production of all kinds of steel ingots and castings in 1911 amounted to 23,675,501 tons, against 26,094,919 tons in 1910, a decrease of 2,419,418 tons, or over 9.2%. The production in 1910 was the largest in the country's history. The year of next largest production was 1909. Of the total production last year 23,029,479 tons were ingots and 646,022 tons were castings, as compared with 25,154,087 tons of ingots and 940,832 tons of castings in 1910. The production of various kinds of steel for the two years was as follows, in long tons:

	1910	1911	Changes
Bessemer (acid)....	9,412,772	7,947,849	D.1,464,923
Acid openhearth...	1,212,180	912,718	D. 299,462
Basic openhearth..	15,292,329	14,685,932	D. 606,397
Crucible	122,303	97,653	D. 24,650
Electric.....	52,141	29,105	D. 23,036
Miscellaneous	3,194	2,244	D. 950
Total.....	26,094,919	23,675,501	D.2,419,418

While all kinds of steel showed decreases, the smallest proportional loss was in basic openhearth and most important in bessemer steel. As all of the bessemer steel made in this county is acid, the proportion of acid steel made in 1911 was 38, and of basic 62 per cent., against 41.4 and 58.6 per cent., respectively, in the previous year.

Twenty-two standard bessemer plants were at work in 1911 and 27 Tropenas plants were running in 1911. In addition 1 plant made steel by the Robert-bessemer process in 1911, and 23 plants made steel in 1911 by the Bookwalter, Bretaud and other modifications of the bessemer process. The openhearth steel ingots and castings made in 1911 were produced by 149 works in 23 states and the District of Columbia. In 1911 there were 28 idle openhearth steel plants. There were nine active electric steel plants last year.

Tonopah Belmont Report

During the fiscal year ended Feb. 29, 1912, the shareholders of the Tonopah Belmont Development Co. were paid four dividends of $375,000 each or a total of $1,500,000, which amount is equal to the par value of the capital stock of the company.

The mine produced 152,599 tons of wet ore from which 33,624 tons was sorted as waste. Of the total production of 115,563 tons of dry ore, 87,349 tons assaying $20.84 per ton were milled and 27,611 tons assaying $61.35 per ton were shipped to the smelters. The gold recovered amounted to 45,069 oz. which was sold for $886,971; the silver production was 4,535,762 oz. and was sold for $2,381,543. The total receipts amounted to $2,881,177 after deducting freight and treatment charges.

The ore treated in the mill contained 0.269 oz. gold and 28.26 oz. silver per ton. The total gold and silver in the ore milled was 23,470 oz. gold, of which 22,066 oz. was recovered, and 2,468,249 oz. silver, of which 2,259,651 oz. was recovered. The average recovery was 92.54% of the total value of the silver and gold. The total operating expense at the mine was $5.439 per ton of ore mined. Milling cost $3.879 per ton of ore milled.

At the end of the year the ore reserves consisted of 348,912 tons of positive ore, 247,907 tons of probable ore, and 109,263 tons of possible ore, a total of 706,082 tons, the value of which is not stated in the report. Development work was hindered by the high temperature, poor ventilation, and by the flow of water encountered below the 12th level. During the year, the Belmont shaft, the main working shaft of the property, was extended to a depth of 1465 ft. This shaft is to be equipped with self-dumping skips of 3 tons capacity to take the place of the double-deck cages now in use. The timbering of the shaft is in such condition that the immediate and complete retimbering from the surface to the 10th level has become necessary, and preparations for this work are now under way. During the cessation of hoisting operations through the Belmont shaft, the Desert Queen shaft will be used.

A new reduction plant of a capacity of 500 tons per day is under construction at the mine and will cost $435,000 when completed. Efforts are being made to obtain a sufficient tonnage of custom ore from other mines to justify the operation of the old mill after the new mill has been completed. Up to the end of the fiscal year, $292,304 had already been expended on this new mill.

Amster Buys R. R. R. Mine near Patagonia, Arizona

By Josiah Bond*

As reported in the Journal of Apr. 13, the R. R. R. copper mine, the property of R. R. Richardson and A. E. Crepin of Patagonia, Ariz., was sold to N. L. Amster, president of the Shannon Copper Co., representing the same interests that control that company. At that time the price was reported as $335,000. The mine was offered at that price but the buyers let their time for paying earnest money slip by with the result that other bidders came in, running up the price finally to $550,000, at which price the deal was closed, payments made and title passed.

At the time of the first offer the lower crosscut had penetrated 14 ft. of ore; at the time of final sale, 24 ft.; now there is in sight 40 ft. and the further wall not yet struck.

The ore is mostly glance, a little chalcopyrite coming in. The first 14 ft. average about 13.5% copper and it is thought that the latter part of the crosscut is richer than this, and that the whole 40 ft. will average 15%. The mine is about three miles from the railroad in the northern end of the Patagonia Range. The railroad company is now putting in a switch for the use of the buyers of the R. R. R. mine as they intend to do business in a large way having already ordered a compressed-air plant, machine drills, etc. William S. Sultan, a mining engineer of Globe, is consulting engineer.

This mine has had a long history beginning more than 25 years ago. Mr. Richardson secured an interest in the mine in 1896 and has since then done about $50,000 worth of work. The mine has been bonded several times, once to the late Colonel Greene of Cananea fame. A great deal of ore has been shipped from the upper levels, the present crosscut being 1000 ft. below the outcrop of the vein. This is the largest body of ore ever cut in a single straight working from the surface in Arizona. The present owners have refused several higher offers for their bargain. The sale and the continuous widening of the orebody has produced great excitement in the country and many other deals are pending.

The Chief group between the R. R. R. and the World's Fair silver mine has been bonded by William Powers and associates to Kansas City men for $50,000, the first payment to be made May 15. Work will commence in about 10 days. Gray Brothers, owning ground contiguous to the R. R. R. have optioned their group at $100,000 to one of the unsuccessful bidders on the R. R. R. mine.

*Mining engineer, Patagonia, Ariz.

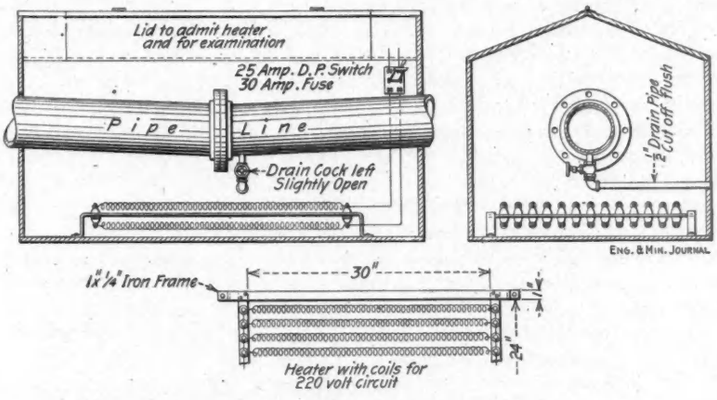
Details of Practical Mining

Accounts of Useful Ways of Doing Many Things in the Day's Work

Electric Heater for Air Line Drains

By G. C. Bateman*

When the Cobalt power companies first started to supply compressed air on a large scale to the mines, trouble was experienced in the winter by the water from the air collecting in the low parts of the pipe lines and freezing. In the pipe lines of the British Canadian Power Co., this difficulty was overcome by the use of an electric heater, designed by James Ruddick, the general superintendent for that company. The device consists of a heater which is placed in a small box built over the drain cocks in the pipe line. These drain cocks are placed wherever there is a drop in the line, so that the water will drain both ways to the cocks.



Electric Heater Used on Cobalt Air Mains

There is a double-pole switch with 30-ampere fuses in each box and the wiring is mounted on cleats to prevent fire. Although the heater takes only 20 amperes the stronger fuses are used to take care of the current when starting, as the coils take more current when cold than when warm. The power required is 4 kw. for each heater.

The British Canadian Power Co. controls about 15 miles of pipe line between 6 and 10 in. in diameter, and several miles of smaller sizes. There are about 25 heaters in use, and since their installation no trouble from freezing has been experienced.

This device can be used advantageously wherever there is trouble from the freezing of surface lines, and as it is a simple device it can be built at the property. For pipes of smaller diameter than those mentioned, a heater of about half of the capacity of the one described can be used, in which case it would be necessary to have current at 110 volts, or less, and sufficient coils can be connected in series, to suit the voltage available. To increase or lower the voltage of the heater, it is only necessary to add or take out coils as the case may be. Should it be found that the heater does not warm up sufficiently, a coil or so can be cut out.

The heater, which is placed underneath the drain cock, is so designed that it fits snugly into the box, and a pipe leads from the cock to the outside of the box. This pipe is cut off flush with the box so that there is no danger of freezing on the outside. The frame of the heater is made of 1x¼-in. iron, and on this frame insulation knobs 1 in. in diameter and 1½ in. long are mounted back to back, as shown in the accompanying illustration, one bolt being sufficient for the two.

The coils are made by winding No. 14 galvanized-iron wire on a ⅞-in. rod, each coil consisting of 100 turns. The heater takes 220 volts, each coil being equivalent to 11 volts and 20 amperes. The coils are arranged so that there is at least an inch of space between them.

*Mining engineer, South Porcupine, Ont.

Alignment in Driving

The remark made in the article entitled "Maintaining Grade in Driving," published in the Journal of March 30, 1912, to the effect that in driving there is a tendency for the miners to advance with too much grade to the floor of the drift suggests another tendency often exhibited when driving on a vein that abruptly passes from relatively uniform rock into a sheeted zone or one wherein many nearly vertical fissure planes exist in close proximity.

Especially when the vein crosses or enters such a zone at an obtuse included angle the tendency for the miners to deflect the direction of the drift a little to one side is pronounced. Due to the way in which the breaking of the rock is influenced by the fissures or joints together with the tendency to advance slightly towards the direction of the joints, the drift in passing through such a zone is apt, when finished, to present a stepped in or jagged appearance.

This tendency must be guarded against or an unnecessary amount of ground must be broken and the drift may be continued out of the alignment desired.

Pumps Work after Long Submergence

By Charles Mentzel*

At the Cordova mines in Ontario there is a 400-ft. shaft in which the pumps were drowned and remained submerged for eight years. A few weeks ago it was decided to unwater the shaft which makes about 15,000 gal. per hour. On the 200-ft. level there is a 7½x4½x10-in. duplex pump of the Worthington type, which was built by the Northey Pump Co. of Toronto—no longer in business. The column pipes and air lines had not been touched in eight years and the water was within 20 ft. of the collar of the shaft. On giving it air, the pump immediately started and pumped 96 hr., then stopped. On reaching the 200-ft. level with a sinking-pump, it was found that a setscrew in a rocker-arm had slipped. After fixing this the pump worked as well as ever.

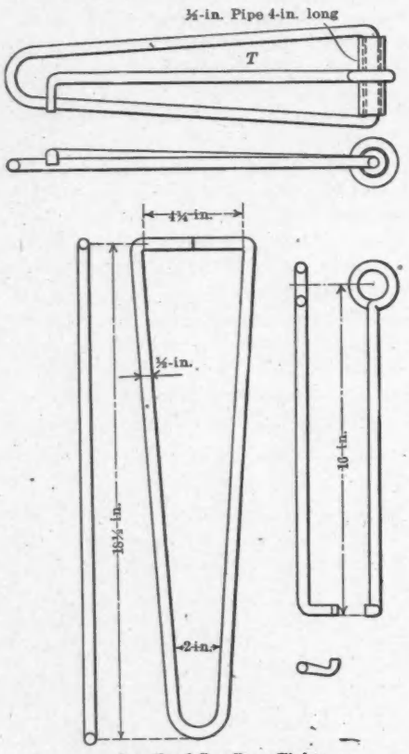
On the 300-ft. level there are two 5¼x3½x6-in. duplex pumps of the same type, lifting to a sump at the 200-ft. level; both discharges being connected to a 5-in. column pipe. Upon turning on the air at the 200-ft. level these pumps immediately began to work and are still pumping after continuous work for a week. On the 400-ft. level there is another pump lifting to the 300-ft. level and no doubt is entertained that on reaching the 300-ft. level and turning on the power, this pump will also do its duty. Under the conditions this work is remarkable.

*Manager, Cordova Mines, Ltd., Cordova Mines, Ont.

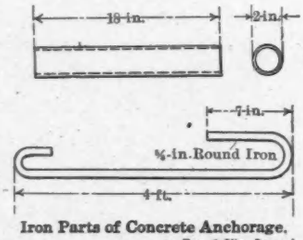
A Guy Rope Tightener

By Claude T. Rice

In the accompanying drawings are shown the details of a guy-rope tightening device which is used in the southwestern Missouri zinc district. The tightening device resembles a buckle in construction. It is made of ½-in. wrought iron, with a piece of pipe over the broad end of the buckle-shaped link so as to allow the tongue to rotate readily without much friction. This tightener



Details of Guy Rope Tightener



Iron Parts of Concrete Anchorage.
Eng. & Min. Journal

Guy-rope Tightener and Anchorages

is fastened to the anchor of ⅝-in. wrought iron after the guy rope has been secured to the tongue of the tightener.

By using the tongue as a lever, the guy line is wound around the broad end of the buckle until the proper tension has been obtained. Then the tongue is locked by hooking its end over the buckle part of the tightener. The iron parts for a concrete anchorage in which a pipe cross piece is used are also shown.

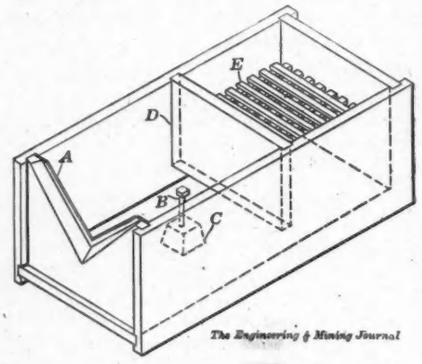
The V-Notch Weir

By E. H. Webster*

In the summer of 1909, the Republica mine in western Chihuahua was flooded, and underground operations were suspended for some months thereafter, production being maintained from ores and tailings which fortunately existed within easy reach on the surface. The mine was allowed to fill just before I assumed charge of the property. It had the reputation of making a large quantity of water, but I was unable to ascertain that any systematic measurement had been made of the flow, the estimates of the quantity pumped being based mainly on occasional observations of pump displacement and revolutions. On commencing the unwatering, in the following year, it appeared desirable to gage the flow, in order to check the performance of the sinking-pumps as well as to have some reliable data as to the volume to be handled in the event of a recurrence of the trouble. Conditions at the mine were such that in order to accomplish this it was necessary to provide some cheap, simple, and fairly accurate measuring device, rigged up from material on the ground, not easily deranged by unskilled labor, and which could be placed near the shaft collar and easily and frequently observed for the rate of flow.

The discharge from the pumps being variable and depending on the number of pumps in action from time to time, this point also had to be considered. Rectangular and Cippoletti (trapezoidal) weirs, on account of the relatively small quantity of water to be handled, hardly seemed to answer the purpose; Pitot and Venturi meters appeared too difficult of construction and application, and open to injury from rough treatment in the location selected, near the shaft; while the triangular or V-notch weir seemed to combine ease of application and observation with accuracy at all rates of flow. From an old box used in the mill for washing screens, I finally devised a measuring box on this principle, adapted from the notch box of an automatic English recorder, in wide use abroad and recently introduced into this country. This was placed conveniently near the shaft, and received the discharge from two 250-gal. sinkers.

In the accompanying sketch of this box, *A* is a thin iron plate, with a sharp-edged 90° V-notch, forming the essential part of the device; *B* is a lag-screw or bolt screwed into the base *C*, which is fastened to the floor of the measuring chamber about two-thirds of the distance from the notch to the baffle; *D* is the baffle board, which divides the box into receiving and measuring compartments, communicating at the bottom; *E* is a grating or screen in the receiving compartment, which breaks up the pump discharge and delivers a quiet flow to the measuring compartment. In setting this box, it must be carefully leveled transversely and longitudinally, to insure a perfectly horizontal position of the base of the notch and the floor of the box. When it is finally leveled and firmly secured, the lag-screw *B* must be adjusted on a dead level with the apex of the notch, in order to form the zero-point for the measurements to be made. It should be tested by running a quantity of water into the box, allowing it to discharge, and observing the water level. The grating *E* should be covered with a wire screen of suitable mesh, or a layer of small rock fragments sufficiently thick to break and diffuse the entering current, while not impeding the flow. The pump discharge should strike this compartment with as little force as is practicable under the circumstances. Care must be taken to see that the triangular crest is beveled thin, with the beveled



Weir for Gaging the Pumping of Mine Water

side facing down stream; also that the end of the box is so arranged that the discharge from the crest is perfectly clear and free. When the box is properly set, a chip thrown into the measuring compartment near the rear will float in the quiet water indefinitely, unless brought quite close to the crest by some extraneous influence.

As a basis for determining the rate of flow, the height from the apex of the notch to the surface of the still water is measured. If these measurements are required with a considerable degree of accuracy, the usual hook gage, or some adaptation, must be attached to the box, for fine reading, but for the purpose in view, this was too refined and too liable to injury, and we decided on a rule, graduated in tenths of an inch, the rule being read at the surface of the water, and the rate of flow taken from the table herewith. Finally, the rates of flow corresponding to the individual tenths were added, and the rule was read direct in

*Los Angeles, Calif.

gallons per minute. The rule was a thin strip of dense wood, graduated in India ink and well coated with shellac afterward. No difficulty was experienced in reading it to the accuracy desired, but it will be noticed that even 0.05 in. means a considerable difference in flow as the height increases, and where conditions admit, the hook gage is preferable.

The rule was hung at the side of the box, and observations were made at frequent intervals, the time and measurement being noted in each case. From these data the average rate of flow was calculated, as closely as the case demanded. In addition to giving this information, the weir was found useful in checking the condition of the sinking pumps. The heat in the cramped shaft was terrific, and the men were inclined to slight adjustments and repairs, but the Mexican pumpmen soon learned to read the rule, and became accustomed to watch the box for the pump duty, especially after adjusting packing, valves, etc., all hands being thus kept well informed as to the effect on the water lifted.

The box is shown as being equipped with a notch 8 in. in depth, and is hardly of the most suitable proportions. Possibly a better adjustment for this depth of notch would be, 4 ft. long, 2 ft. deep, and 2½ ft. wide. While the recording devices of the apparatus from which it is copied are patented, I do not know whether the weir box itself is or can be the subject of a patent; the notch itself, of course, is part of the common stock of engineering knowledge and available to all.

The table is calculated to the nearest tenth of a U. S. gal. per minute, and is based on the Thomson formula. Recent investigations at Glasgow gave coefficients varying somewhat, and slightly lower, but these figures were not available when the table was prepared.

The usefulness of a simple and accurate device of this kind is unquestioned. It is a safe assertion that a majority of mine pumps are working at much lower efficiency than their proper duty, and this is to be expected as usually no means of gaging the flow are provided, except an occasional revolution counter and the plunger displacement figures. In some cases the slip is estimated or guessed at more or less vaguely according to conditions and the personal equation of the men in charge, but generally it is not even considered. What this means under mining conditions, is shown by the statement of R. V. Norris, in an article "The Unwatering of Mines in the Anthracite Region," in the *Engineering Magazine* of October, 1907: "It has been notable that where water-hoisting has replaced a pumping plant the quantity of water previously figured on plunger displacement has invariably diminished to about 60% of that previously reported. The difference is accounted for partly in slip, and partly because proper allowance is rarely made for delays and low speeds in mine pumps, which until recently were rarely provided with counters."

Furthermore, even with pumping plants of larger capacity than the average mine plant, and working under infinitely more favorable conditions, matters seem to have been nearly as bad. In the *Municipal Journal and Engineer* of Dec. 16, 1908, a table of tests is given, covering 67 waterworks pumps in more than 30 American cities, the slip being determined by Pitot instruments of improved type. The slip ranged from 1 to 73.8%, and on the 67 pumps tested was distributed as follows:—1 to 5%, 19; 5 to 10%, 9; 10 to 20%, 14; 20 to 30%, 12; 30 to 40%, 5; 40 to 50%, 3; 50 to 60%, 2; 65, 2; 73.8%, 1. If this is the case with large waterworks pumps of good construction, operating under favorable conditions, and under the supervision and inspection of men appointed for their engineering qualifications, what would a similar testing of average mining plants show?

The installation of such weirs, either the simple form shown herein, or the perfected automatic recording form mentioned above, would greatly reduce the figures claimed by many mine managers and mechanics as representing the water being lifted at their plants. Further consideration of the weir figures would show the enormous waste of power in handling this water, and should stimulate investigation and effort to locate the responsibility for this waste, whether in the pumps themselves, in their condition and handling, in the condition of the boilers or power plant, or in the capabilities of the men in charge. This burden of responsibility may be distributed over all the elements indicated, or it may rest on only part of the system; but in order to fix it, some basis must be taken, and this basis is the accurate determination of the water actually issuing from the pump discharge.

Owing to its simplicity and portability, the V-notch weir should also be found useful in other departments of the mine wherever quantities of water or solution are handled; but wherever the expense is justified, the automatic continuous recording apparatus should accompany it. As regards mine pumping, due to the importance and cost of this department of mining, an accurate recording apparatus would seem to be a necessity, if any check at all is to be kept on the efficiency of the pumping plant and the cost per ton, million gallons, etc., of handling the water.

DISCHARGE OVER 90° V-NOTCH WEIR
IN U. S. GALLONS (231 CU.IN.) PER MINUTE

Head, Inches	TENTHS									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	.....	0.007	0.04	0.11	0.23	0.40	0.64	0.94	1.3	1.8
1	2.3	2.9	3.6	4.4	5.3	6.3	7.4	8.6	9.9	11.4
2	12.9	14.6	16.4	18.4	20.4	22.6	24.9	27.2	30.0	32.8
3	35.7	38.7	41.9	45.3	48.8	52.5	56.3	60.3	64.4	68.8
4	73.2	77.9	82.7	87.8	93.0	98.3	103.9	109.6	115.5	121.7
5	128.0	134.4	141.1	148.0	155.1	162.4	169.9	177.8	185.4	193.5
6	201.8	210.4	219.1	228.0	237.2	246.6	256.2	266.0	276.0	286.3
7	296.8	307.5	318.4	329.6	341.0	352.6	364.5	376.6	388.9	401.5
8	414.4	427.4	440.7	454.3	468.1	482.2	496.5	511.0	525.8	540.9
9	556.2	571.8	587.7	603.7	620.1	636.7	653.6	670.8	688.2	705.9

Formula: U. S. gal. per min. $= 2.28904\sqrt{H^5}$, where H equals head in inches; adapted from Trautwine's form of Thomson formula for flow in cu.ft. per sec. $= 0.0051\sqrt{H^5}$.

Cement Gun Concrete at Panama

The coating of cement mortar applied by the pneumatic cement gun which was sent to the Isthmus of Panama a little less than a year ago for use in spraying the surface of certain rock faces in Culebra Cut, which disintegrated on exposure to air, was found, according to the *Canal Record*, not to prevent this disintegration. The concrete mixture sprayed on the smooth surfaces adhered uniformly, but was not sufficiently airtight to retard appreciably the progress of disintegration. The gun was used recently on the relocated line of the Panama R.R., in coating the surfaces of hand-laid revetment wall, made of hard Bas Obispo rock. In this case the concrete penetrated the interstices of the rocks as far as several feet and thus a firm hold was obtained. Using a mixture of 1 part of cement to 3 of sand for the inner coating, and of 1 part of cement to 2 of sand for the final surfaces, it was practicable to lay a smooth, strong coat from 2 to 3 in. thick, over an area of about 25 ft. square per day. The spraying was continuous. By the time the work had been carried from one end of the area under treatment to the other the first part was ready for another coat. In all, about 10,000 sq.ft. of revetment was treated. An opinion has been expressed to the effect that the failure of the cement coating at Culebra was due to the rock flaking off back of the surface.

Friction in Air Pipes*

By E. G. Harris†

The coefficients given in the accompanying tables were determined experimentally for use in calculating the friction of air in pipes by the formula

$$f = c\frac{l}{d^5}\frac{V^2}{r}$$

where f is the loss by friction in pounds per square inch; l, the length of pipe in feet; d, the diameter of the pipe in inches; V, the quantity of free air passing expressed in cubic feet per second; r, the ratio of compression in atmospheres, and c, the coefficient.

TABLE I. COEFFICIENTS FOR FRICTION IN AIR PIPES

Diameters in Inches		Coefficient c for	
Nominal	Actual	Actual Diameter	Nominal Diameter
¼	0.63	.....	.....
⅜	0.82	0.110	0.069
1	1.07	0.100	0.071
1½	1.63	0.089	0.059
2	2.07	0.082	0.069
3	2.874	0.072	0.089
4	3.937	0.066	0.071
5	4.921	0.062	0.067
6	5.960	0.059	0.061
7	.....	0.056	.....
8	7.874	0.053	0.059
10	.....	0.050	.....
12	11.811	0.048	0.052

For the ¾- and ½-in. pipes, especially the latter, the results of the experiments were so irregular, erratic and conflicting, that the coefficients given in the tables for those sizes cannot be accepted as final. In light of these studies it is not probable that a satisfactory coefficient will ever be obtained for pipes less than one inch diameter, the reason being that in such pipes irregularities have relatively greater effect than in larger pipes. No doubt consistent results could have been obtained by using only pipes that had been "plugged and reamed'" and selected fittings; but the results would not have been a safe guide for practice.

TABLE II. LENGTHS OF PIPE IN FEET OF RESISTANCE EQUAL TO THAT OF FITTINGS

Nominal Diameter of Pipe	90° Elbows	Un-reamed Joints, Two Ends	Reamed Joints, Two Ends	Return Bends	Globe Valves
¾	10	2 to 4	1	10.0	20
1	7	2 to 4	1	7.0	25
1½	5	2 to 4	1	5.0	40
2	4	2 to 4	1	4.0	45
3	3	2 to 4	1	3.5	47

A number of experiments were made to determine the resistances of 50-ft. lengths of rubber-lined, armored hose, such as is used for connecting air tools with the supply of compressed air. These, given in Table III, include the resistance in a 50-ft. length with the metallic end couplings, where considerable contraction occurs; in ½-in. hose the end couplings are ¼ in. The excessive resistance in the ½-in. hose may have been due to these end contractions or to some other obstruction. It is a further illustration of the fact that reliable coefficients cannot be obtained for pipes of less than one inch diameter.

TABLE III. RESISTANCE OF AIR HOSE

Diameter, inches	½	¾	1	1½
Resistance in 50-ft. length*	$950\frac{V^2}{r}$	$20\frac{V^2}{r}$	$4.5\frac{V^2}{r}$	$2.6\frac{V^2}{r}$

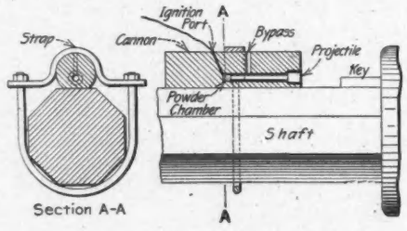
*Excerpt from a bulletin "Friction in Air Pipes," of the School of Mines and Metallurgy, University of Missouri.

†Professor of Civil Engineering, University of Missouri, Rolla, Mo.

A Cannon for Loosening Keys

When the drive pulley of a stamp-battery camshaft is keyed to the shaft by the ordinary type of key, trouble is often experienced when an attempt is made to remove the pulley, the key sticking so tightly as to make ineffectual all ordinary means of loosening it. For jarring loose all such keys a cannon described in *Power* may be used to advantage. This cannon was designed for loosening the keys that held the paddle-wheel of a river boat to the shaft.

A piece of 6-in. steel was planed flat on one side so that it could be clamped on the hexagonal paddle-wheel shaft. It was then bored with a 1½-in. hole to form the cannon bore. A steel projectile was then made to tightly fit the bore of the cannon. The hammer-shaped end protruding from the bore was hardened. A hole was bored into the cannon at a point where the projectile would pass it at the time it struck the key, the object of which was to relieve the pressure in the cannon without shooting the projectile out of the gun. A vent was bored into the powder chamber for an ignition port, and the igniting powder was fired by a piece of fuse. The construction and operation of the device is at once apparent upon inspection of the accompanying illustration.



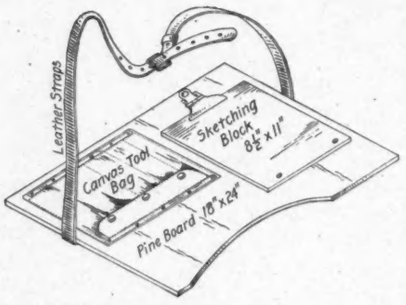
Cannon for Shooting Out Keys

This device should prove effectual in loosening rusted keys, but in using it all men should retire to a safe distance in order to avoid injury should the cannon burst.

In driving out tapered keys, or keys with a head, a special driving-out key is used, one end of which is headed to receive the impact of the projectile and the other end of which is small enough to enter the keyway and strike against the small end of the key to be driven out.

Sketching Board for Use Underground

The accompanying illustration shows a convenient sketching device for use of the mine surveyor's note taker. It consists of a small drawing board about 18x24 in. It is intended that when the board is in use it will be hung from the shoulders. For this purpose, writes R. B. Dale in the *American Machinist*, leather shoulder straps are attached on each side at a point a little beyond the center. When the device is not in use it may be allowed to hang vertically from the shoulders and the user is but little inconvenienced in moving or climbing about. The straps are adjustable as to length. The side of the board nearest the user is cut away slightly to conform to the natural form of the body.



A Convenient Sketching Device

The board is provided on the right with a sketching block or pad, which is securely held by means of a spring clip. Two small pegs at the lower end fit into corresponding holes in the block to prevent it from slipping about. It is intended that the sketches when completed may be removed from the block and inserted in a loose-leaf book cover.

On the left side the board is provided with a canvas tool bag which is fastened to the board by means of thin metal strips at each end. The canvas flap may be fastened down by means of straps and buckles or snap fasteners as desired. The bag is divided into compartments in which to keep tools, instruments and notebooks. It is thus seen that provision is made for the storage of a complete sketching equipment.

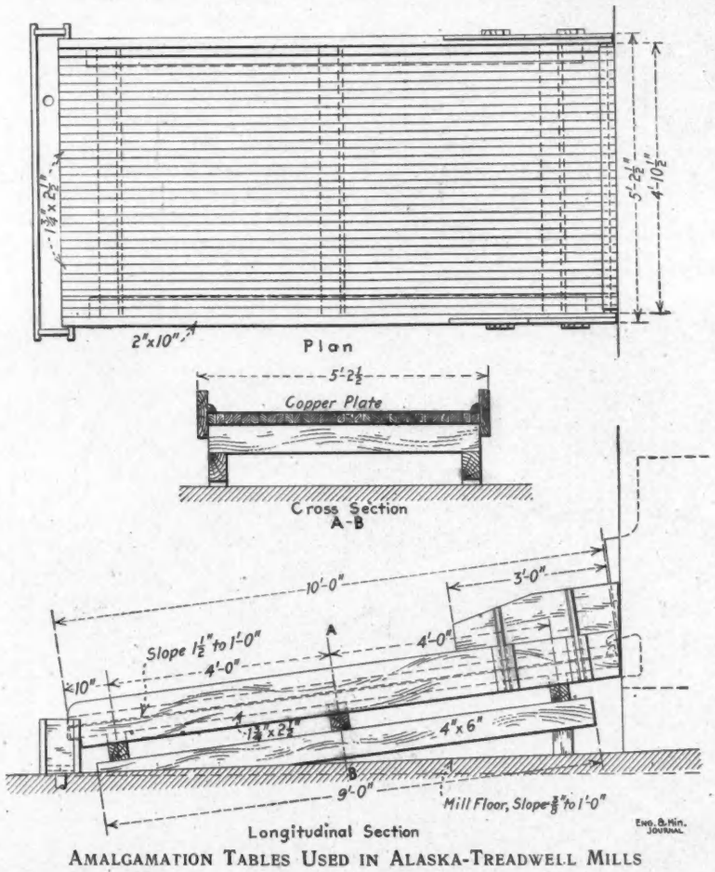
When taking measurements the board may be laid to one side if necessary in order that the draftsman may move freely about. A sheet of celluloid may be kept under the hand to protect the sketch from the dust and dirt.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Alaska-Treadwell Amalgamation Tables

The amalgamation table illustrated by the accompanying drawing is the standard design used in the five mills on Douglas Island controlled by the Alaska-Treadwell Gold Mining Co. and affiliated interests. One large copper plate is used for each battery of five stamps. As compared with the Homestake tables described in the JOURNAL of April 13, 1912, the Alaska-Treadwell table is wider, but shorter. The pulp from the tail-box at the lower end of the table is conveyed to the concentrators.



AMALGAMATION TABLES USED IN ALASKA-TREADWELL MILLS

The body of the table is made up of a number of 1¾x2½-in. squared timbers planed smooth on the sides to make a tight joint and on the upper surface upon which the copper plate is supported. These timbers are held tightly in place by the transverse timbers on the bottom. The copper plates are held in position by the rounded cleat on each side and at the upper end of the table.

The plates are dressed once per day, but if trouble from scouring, or from other causes is experienced, they are dressed as required. The operation is started by hanging up five stamps, first shutting off the feed so as to reduce the ore in the mortar to the level of the dies. The five stamps are then hung up, and a portable trough placed at the end of the plate, on the inside of the tail box. The plate is then brushed from the top toward the bottom with whisk brooms; it is then cleaned by rubbing with cloths saturated with a weak solution of cyanide. If quicksilver is required, it is now added and rubbed first with the cloth dampened with cyanide solution, and then brushed with whisk brooms at right angles to the flow of the pulp. The portable trough is then removed, some ore fed by hand into the mortar and the stamps dropped. The operation from start to finish takes on an average four minutes per plate. The present practice is to add very little quicksilver to the plates, except during the cleanup period which occurs once per month. During the remainder of the month the quicksilver is fed to the mortars, and the quantity so fed is sufficient to keep the plates in good condition.

Scraper for Loading Tailings

The accompanying halftones show a type of scraper that is used in the Joplin district of Missouri for loading tailings into the bins of a tailings mill or into railroad cars. The scraper is hauled back and forward by a tail and haulage rope, operated by a two-drum engine. The scraper is made with two sides, held together by cross braces. The scraper shown in one of the illustrations is fitted with cross braces only at the top. These are flat bars that extend down on the outside of the side pieces or runners, as they might be called. In the scraper shown in the other illustration, tie-rods are used for bracing the runners, both near the top and near the bottom, with distance pieces of pipe over the bolts.

The principle of this scraper is simple. It has no bottom like an ordinary dirt scraper, for it does not carry its load, but scrapes it ahead. The back wall of the scraper is a hinged door that, when the scraper is moving forward, is prevented from swinging clear back by a cross rod near the bottom of the scraper. On the other hand, when the scraper is returning for its load, the door is free to swing, and so the scraper accumulates no load. In the scraper shown in use, no wearing plates or shoes are used on the runners, and there are no wings bolted to the side walls to regulate the distance that the scraper can sink into the tailings. These wings are not necessary to the efficient working of the scraper.

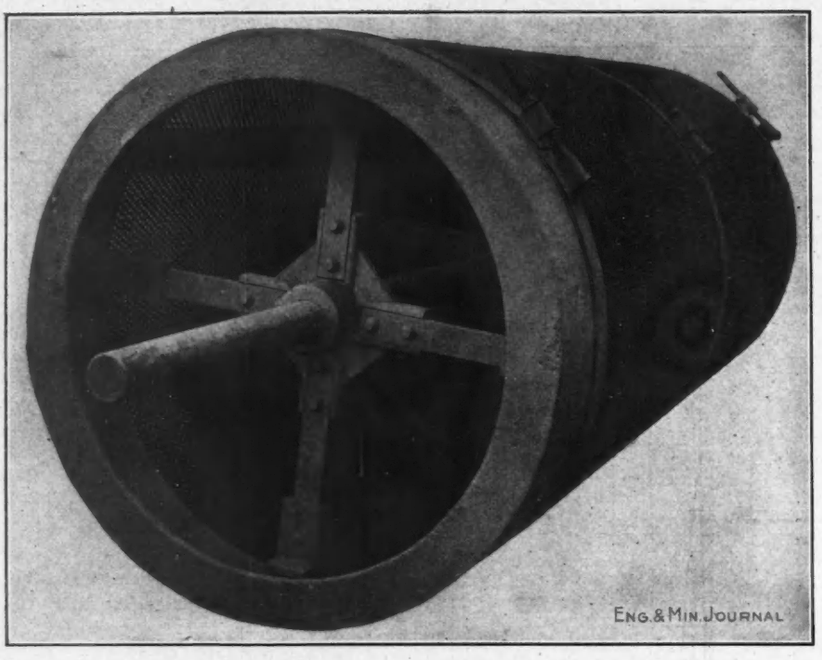
On the scraper shown with wings, there is also a sheave wheel at the back end. This is to go over the return rope; then, if the return rope is kept taut, the scraper can be made to cross hollows, if used in making fills, and also in dumping the load at the mill bin. Such a system of scraping the tailings into the mill is used at the Oronogo Circle tailings mill, as well as elsewhere in the Joplin district.

The dimensions of the scraper in use at the Oronogo Circle mine are: Length, 5 ft. 2 in.; width at front, 3 ft. 6 in.; width at rear, 2 ft. 10 in.; depth of sides, 14 in. The tie-rods are ¾-in. rods with 1-in. pipe over them for spreaders. There are two tie-rods at the top and two at the bottom, the rear one at the bottom being the one that the rear door rests against when pulling the load ahead. At

the front and rear ends, the walls are reinforced, as well as tied together by the 3x½-in. straps that are riveted to the sides. The rear end of the scraper is beveled off at about the angle that the door assumes while the scraper is being pulled ahead with its load. The rear door is of sheet iron about ⅛ in. thick that is swung by two 2x½-in. straps from the upper rear tie-rod. These straps are riveted to the door 8 in. out from each side wall. The door is 17 in. deep and hangs about one inch down from the tie-rod. Both the two rear tie-rods, as well as the front tie-rod, by which the scraper is attached to the haulage rope, are seated in reinforcing straps.

Joplin Trommels

The trommels used in the mills in the Joplin district of Missouri are shown in the accompanying halftone. Two sizes are used in the district, 48x96 in. and 36x96 in. The framework of both is the same except as to the diameter of the hood and the length of the arms of the spider. The arms are protected at the ends by castings that are fastened to the arms by a ¾-in. rivet. This protecting casting is made of two parts, a plate and the shoe. The plate is a casting with walls ⅝ in. thick that come half over the arms of the spider, which are pieces of 2½x½-in. iron, bent at the ends so as to fasten by two ¾-in. rivets to the hoops of the trommel, which are also made of 2½x½-in. iron. The shoe is of the same section as the plate in the shank part, but at the bottom is a projection at right angles, so as to cover the heads of the rivets that fasten the arms to the hoops. This is done because the ore going to these trommels is abrasive and hugs the bottom of the trommel. If these protectors were not used, the arms would wear away rapidly. As it is, the protectors can easily be replaced as they are worn out.

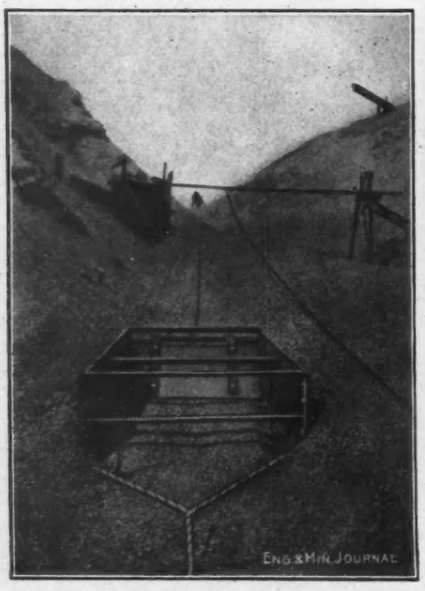


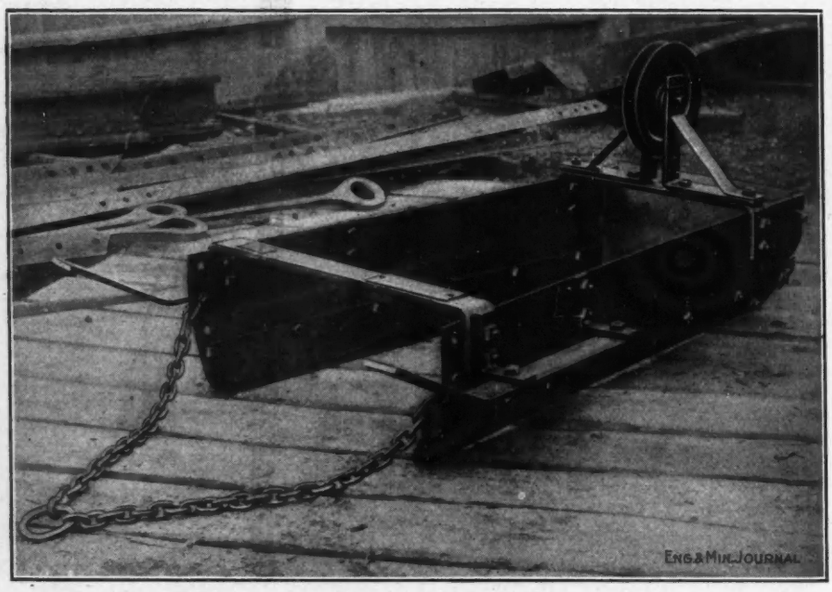
JOPLIN TROMMEL, SHOWING DESIGN OF SPIDER AND DRAWBAND

The spiders of the trommel are composite, being made of a hub casting, and the arms, that are riveted together by ¾-in. rivets. The hub is fastened to the shaft by a key and two setscrews, one of which comes over the key. On the hub are ribs for receiving the arms.

The trommel in the drawings is shown with the type of drawband used by J. A. Rogers in the trommels that he put on the market. The sockets for the drawband bolt are made by punching two slots through the drawbands to receive a U-clip 2½ in. wide and of No. 8 sheet gage. This clip goes over the drawbolt and clinches over backward, so that it cannot draw out of the slots as tension is put on the band. Moreover, as the drawbolt is tight against the band, this clip does not have the tendency to turn over that develops in those having cast-iron sockets for the drawbolts riveted to them.

The ore is fed into a cast-iron hood on the trommel. This hood is of the same diameter as the trommel and its walls are cast ½ in. thick. The side wall comes up 3½ in., and the wearing wall extends out from the side wall 10 in., so that the feed as it comes into the trommel drops on the hood casting and it takes the wear instead of the trommel screen.





SCRAPERS USED AT JOPLIN FOR LOADING TAILINGS

The Cost of Doing Things

Data from Mining and Metallurgical Practice

Melting Gold Precipitates

Using a Faber du Faur tilting furnace with coke fuel, it requires at a certain mine 24 hours to melt approximately 700 lb. of gold precipitates and flux, including time required for changing broken crucibles and a remelt of bullion.

Crucible consumption: This depends upon the nature of the precipitate melted. It is possible for it to run as high as 1½ crucibles per 24 hours. From 1 to 1½ hours is the time usually consumed in dropping the fire, pulling out front of furnace, changing crucible and getting fire under way again.

Coke: It requires about 200 lb. of coke to get the furnace well packed after the wood necessary to start the fire has burned out. The coke consumed depends a great deal upon the regulation of the draft. If the fire is kept at a steady white heat, from 650 to 700 lb. of ordinary-grade coke is consumed per 24 hours.

Flux: Usually the flux used consists of 50 parts borax and 20 parts sand, to 100 parts of precipitates. In some cases a small amount of cyanide or niter is used and in other the greater part of the flux is composed of soda.

Grinding and Mixing: The time required for this operation depends upon the size of grinding barrel used. For a plant making about 400 lb. of dry precipitates per month and only using one melting furnace, a barrel 2½x3½ ft. is often used. It requires about three hours to grind the precipitates, mix flux and sack 700 lb., which is the approximately total weight after flux has been added. This is with one man performing the work, and sacking from 10 to 15 lb. to a paper bag. Where one furnace is operated, one man can perform all the necessary work, except changing crucibles.

Food Supplies for Miners

Arthur A. Cole, mining engineer for the Temiskaming & Northern Ontario Ry., in his admirable report for 1911, gives the accompanying valuable data of the food supplies consumed by 3020 men in the Cobalt district in 1911, the figures having been supplied by the several mining companies of the district.

Mr. Cole also gives the accompanying data of the food supplies for 122 horses.

FOOD SUPPLIES FOR STABLES FOR MINES AT COBALT, 1911

Article	Quantity	Cost	Quantity per Horse per Year	Cost per Horse per Year	Quantity per Horse per Day	Cost per Horse per Day
Hay	991,250 lb.	$ 7,333	8,152 lb.	$ 60.11	22.27 lb.	$0.165
Oats	713,882 lb.	10,058	5,851 lb.	82.44	16.03 lb.	0.226
	.....	$17,391	.....	$142.55	.....	$0.391

FOOD SUPPLIES FOR COBALT MINES, 1911

Article	Quantity	Cost	Quantity per Man per Year	Cost per Man per Year	Quantity per Man per Day	Cost per Man per Day
Flour	9,576 bags	$27,842	317 lb.	$9.22	0.87 lb.	$0.0253
Potatoes	18,918 bags	21,554	626 lb.	7.14	1.72 lb.	0.0196
Vegetables	.....	21,520	.....	7.12	.....	0.0195
Cereals	.....	3,290	.....	1.09	.....	0.0030
Cornstarch	.....	688	.....	0.23	.....	0.0006
Biscuits	.....	2,005	.....	0.66	.....	0.0018
Beef, veal, mutton, lamb	1,039,932 lb.	134,944	344 lb.	44.69	0.94 lb.	0.1224
Pork, ham and bacon	504,396 lb.	66,483	167 lb.	22.01	0.46 lb.	0.0603
Fowls	19,152 lb.	4,897	6 lb.	1.62	0.02 lb.	0.0044
Lard, etc	113,760 lb.	15,729	38 lb.	5.21	0.10 lb.	0.0143
Butter	211,518 lb.	54,890	70 lb.	18.18	0.19 lb.	0.0499
Eggs	2,240,840 lb.	46,967	742 lb.	15.55	2.03 lb.	0.0426
Milk and cream	.....	21,010	.....	6.96	.....	0.0190
Cheese	20,718 lb.	3,218	7 lb.	1.06	0.002 lb.	0.0029
Fruit, jams	.....	60,556	.....	20.05	.....	0.0549
	.....	$485,593	.....	$160.79	.....	$0.4405

Copper Queen Smelting Operations

During 1911 at Copper Queen smeltery at Douglas, Ariz., an average charge of 353 tons per blast furnace was treated per day. Of the total charge treated, exclusive of coke; 75.3% was ore; 0.3% was flux, and 24.4% other copper material. Of the various ores smelted, 73.7% was Copper Queen ore; 13.1% Moctezuma ore and concentrates; and 13.2% custom ore, etc. The coke consumption amounted to one ton of coke for every 8.76 tons of material in charge.

One ton of flue dust was recovered for every 17 tons of material in charge and coke consumed. Based upon the total contents of the ore as represented by the amounts recovered in bullion and contained in flue dust, the flue dust contained 13.6% of the copper; 8.7% of the silver, and 7.1% of the gold.

In the sampling works one sample was made for every 44.5 tons of ore sampled. In the laboratory, one determination was made for every 13.8 tons of charge, exclusive of coke.

Michigan Iron Mining and Furnace Production

The commissioner of mineral statistics for the state of Michigan gives data in his 1908 report from which some interesting unit costs can be obtained.

At the Hartford mine, Negaunee, 248 men were employed and 20 power drills used, producing 272,441 tons of soft, hematite ore; this is equal to 1100 tons per year per man or 13,622 tons per drill per year. For hoisting, 5½-ton skips were used and the production came mainly from the 650-, 750- and 825-ft. levels.

The Champion, one of the oldest iron mines in the Lake Superior region, produced 53,758 tons of ore, employing 120 men and operating 12 power drills, which is equivalent to 448 annual tons per man and 4480 tons per year for each drill. Mining was done by the underhand system and 4-ton skips used in hoisting.

At the Lake mine, of the Cleveland-Cliffs company, in Ishpeming, Mich., 272 men were employed and 10 power drills operated, producing 341,845 tons of ore. This gives an average of 1255 annual tons per man and 34,184 annual tons per power drill. During this time the mine was operated through a four-compartment, 10x16-ft. shaft, 450 ft. deep. The daily capacity of the mine was about 1850 tons. Skips were operated in balance and raised three tons per trip. All tramming was by electric haulage, dumping direct into skips. In 1907 this mine produced 556,573 tons of ore and used 930,846 ft. b.m. of timber underground, which is equivalent to 1.68 ft. per ton of ore produced.

At the Austin mine, Princeton, Mich., the production for 1908 was 197,411 tons of ore, 189 men were employed and five power drills operated, three of which were used in ore recovery. The annual tons per man on this basis is 1045, per

power drill at the mines, 39,480 tons, and 59,470 tons per drill employed in ore extraction. The mine was operated through one shaft, 10 ft. 8 in. by 11 ft. 4 in., and 238 ft. deep. Skips carrying two tons to a trip were operated singly. The caving system was used for mining the ore.

The Chapin mine, near Iron Mountain, Mich., produced 450,177 tons, employing 368 men and operating about 50 power drills. This is equal to 1250 annual tons per man and 9003 tons per drill operated. The underground operations were conducted through two three-compartment shafts; one, 7x21 ft., 1418 ft. deep; and the other, 7x18 ft., 1525 ft. deep. The orebody consists of a series of lenses extending easterly and westerly 6100 ft. and varying from 50 to 150 ft. in width.

The Norrie mine on the Gogebic range employed 1057 men and operated 40 power drills, producing 917,543 tons of ore. This is approximately 868 annual tons per man and 22,938 tons per year per drill operated. Various systems of mining are used depending upon conditions. Electric trams were operated and dumped direct into skips.

BLAST FURNACES

Eight blast furnaces were operated in the state during 1908, producing 142,744 tons of pig iron. At the Cleveland-Cliffs Iron Co.'s Pioneer furnace at Marquette an average of 244 annual tons of pig iron was produced per man employed and 412 tons at its Gladstone furnace, or an average of 326 annual tons per man for the two. The Lake Superior Iron & Chemical Co. secured 197 annual tons per man at its Boyne City furnace and 212 annual tons at the Elk Rapids furnace, or an average of 199 annual tons per man for the two.

The Antrim Iron Co., Mancelona, Mich., secured 228.8 annual tons per man, and the Mitchel-Diggins Iron Co., Cadillac, Mich., operating only three months produced 7949 tons, employing an average of 75 men.

Cost of Mine Fires

It has cost the Giroux Consolidated $34,521 to the end of December for repairing the damage done by the fire which started in the Giroux shaft at Ely, Nev., on Aug. 23, 1911. The distribution of cost was as follows: Putting out fire and getting ready to repair shaft, $6916; repairing shaft, stations, pockets, and drifts $11,847; bailing water and hoisting, $15,756. Two bailers were used, each held 7.3 tons or 1750 gal. of water. The rate of hoisting averaged as high as 1249 gal., or 5.21 tons of water per minute for a period of 24 hours. The depth of hoisting ranged between 1200 and 1400 feet.

During the year 1911 mine fires in the Holbrook division and the Lowell division of the Copper Queen mines in Arizona added 10.7c. per ton to the cost of extraction.

Data on Underground Mining

The data given in the accompanying tables were obtained from the records of a large mine in Nevada, where all mining is done underground. The development figures are based on records for 4354 ft. of work, including the usual proportion of raising generally necessary in opening new ground. All shifts are of eight hours' duration.

DEVELOPMENT DATA

	Per foot of advance
Average shifts of miners	0.655
Average shifts of shovelers and trammers	0.428
Pounds of dynamite	4.79
Number of blasting caps	2.74
Feet of fuse	17.45
Candles	4.28

During the same period the records for work in the stopes were:

STOPING DATA

	Per ton of ore stoped
Average shifts of miners	0.16
Average shifts of shovelers and trammers	0.095
Pounds of dynamite	0.446
Number of blasting caps	0.364
Feet of fuse	1.97
Candles	0.97

Based on the total tonnage of ore produced both from development and stoping for the same period, these figures are as follows:

MINING DATA

	Per ton of ore produced
Shifts of miners	0.271
Shifts of shovelers and trammers	0.169
Pounds of dynamite	1.46
Number of blasting caps	0.899
Feet of fuse	5.45
Candles	1.73

This would indicate that the underground workers handled 2.32 tons per man per shift, or a little more than 2 tons per man per shift, including all men employed about the mine. This average was later increased to about 3 tons per man. The number of candles used is dependent upon the distance to the working faces and draft. Approximately 14 tons of dry ore from stopes per shift of shovelers and trammers was the average at the time these records were made.

Loss of Time from Accidents

The accident report of the Copper Queen Consolidated for 1911 states that the average number of men employed underground was 1505 and that 282 were employed on surface around the mines, making a total average of 1787 men, not including ore dressing. Figuring on the basis of the average number of men employed, the report shows that by accident, 0.45% were killed; 4.65% were seriously injured, and 39.4% were slightly injured, making a total of 44.5% of all the men employed around the mines who met with accidents. These figures show that not considering the more important features of an accident, the loss of time must be reckoned as no small item, when considering the cost of accidents.

The average men employed, accidently injured, may seem high but as this figure must include every injury cared for by the hospital department, such as small cuts and bruises, it is not an exceptional record. Assuming that the average loss of time per man, slightly injured was one-half hour; and that those seriously injured were disabled for only 10 days each; the total loss of time was approximately 874 shifts, not including time lost due to fatal accidents.

Unit Labor Costs in Brazil

Some idea of the inefficiency of cheap labor can be gained by looking over the record of the Ouro Preto gold mines at Ouro Preto, Brazil. Practically all labor is native Brazilian, though various attempts have been made to import miners from Spain, but so far it has been impossible to get them to remain. In 1910 a system was introduced giving a bonus to men working underground who would work 24 days per month.

The average tonnage broken per man per month, based upon the men charged to stoping averaged 10.2 tons in 1909-10; 10.4 tons in 1908-9 and 11.3 tons in 1907-8. The 1910-11 report shows that the labor required per annual ton is all out of proportion to that required where efficient miners can be secured. The average number of men employed per day was as follows:

Administration, one man for every 6950 annual tons (2000 lb.) ore produced. Development, one man for every 1405 annual tons of ore, or only 40 ft. of advance work per year per man, of which only 2% was sinking. Stoping and tramming, one man for every 125 annual tons ore. Pumping, one man for every 3480 annual tons. Water course, one man for every 7720 annual tons. Mill, one man for every 590 tons ore milled. Cyanidation of concentrates, one man for every 360 tons concentrates treated annually. Cyanidation of sands, one man for every 9420 annual tons sands treated. Cyanidation of slimes, one man for every 2260 annual tons slimes treated. Hospital, one man for every 204 men employed.

Based upon the average number of men employed, 48.5% were treated at the hospital for slight injuries received in the mines.

The total men employed in developing, stoping, hoisting and pumping equaled one man for every 105 tons produced annually. The total in milling and cyanide department averages one man for every 485 annual tons. The rate of production per man employed in all departments is 81 tons per year. The total cost of production for 1911 is given as $6.07 per ton.

Cyaniding of Concentrate

By E. M. Hamilton*

Four methods of handling concentrate are possible: Do not remove from pulp; remove, regrind and return to pulp; remove and cyanide separately; remove and ship to smelter. Individual circumstances determine the best procedure. Cyanide consumption is an important factor; a regenerative method, adapted to ores high in silver, is suggested.

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The cyaniding of concentrate has been attracting considerable attention during the last few years, and the present article offers for consideration some aspects of the subject drawn from my personal experience.

Gold Ores With High Silver Considered

At the outset it is necessary to be careful how one makes generalizations, because conditions are so often dissimilar when dealing with different ores. Someone, perhaps, writes that he has solved the problem of cyaniding concentrate; but what does it really mean? Merely that he has found a profitable method for treating the concentrate from some particular ore or group of ores.

The difficulties in this branch of cyaniding have a tendency to be fewer and less important in the case of gold ores than in that of ores containing a considerable amount of silver, and it is only the latter class that is considered here.

In dealing with concentrate there are four possible courses open to the metallurgist:

(1) He may disregard it entirely and allow it to take care of itself.

(2) He may remove it from the pulp for the purpose of regrinding it to a given fineness and then return it to receive treatment in the ordinary course.

(3) He may remove it and keep it apart for a separate cyanide treatment in a plant specially designed for it.

(4) He may remove it and ship it to a smelter.

Until recently the last has been the method most usually adopted. The best course to take, however, depends on a number of factors, such as the assay value of the material, the distance of of the mill from a railway and from the smelter, the cost of treatment at the mine, and the extraction that can be obtained.

With regard to the latter, a mere percentage figure, whether it be 95% or 99%, has no bearing on the question; the thing to be considered is the money equivalent of the precious metals which will have to be thrown away in the residue. In this connection, it is difficult to see what is to be gained by a treatment at the mine if there is enough left in the concentrate to make it worth shipping to a smelter after treatment, except in a case where the railway freights on high-grade material are prohibitive. But however that may be and leaving on one side such matters as disputes over settlements with the smelter, (a subject rather indefinite but which nevertheless gives rise to a certain amount of irritation) the choice must be made solely on the answer to the question, "Which method will leave the greatest net gain in dollars and cents?"

A few concrete examples are here given in illustration of the behavior of various gold and silver concentrates encountered in Mexico, as it affects this question, avoiding reference to those that consist largely of lead and zinc sulphides, and those that are essentially composed of manganese oxides carrying refractory silver.

First Concentrate Chiefly Pyrite

The concentrate at mill No. 1 is a simple one of about 75% pyrite and 25% silica; gold, $735 per ton; silver 202 oz. per ton. This had been shipped to the smelter for several years, but on extraction tests being made by fine grinding and cyaniding it was evident that it could be treated at the mine with profit over shipping. Accordingly plans were drawn up for a concentrate-treatment plant and part of the material ordered. In the meanwhile extraction tests were continued and certain results therefrom suggested to me that it might pay even better to leave the concentrate in the pulp to take care of itself. Careful experiments were then made as to the relative extraction made by the two methods, and though regrinding and separate cyaniding gave a much lower residue, yet, taking into account all the costs, there appeared a net gain of $5 per ton of concentrate by doing away with concentration.

In this particular case it happened that the gain in extraction by regrinding to pass 200 mesh was comparatively small and a sample of the concentrate taken direct from the vanners and agitated for 3 days with 0.5% cyanide solution yielded 96% of its gold and 97% of its silver. It may be mentioned in passing that at the mill in question separate sand and slime treatments were in operation and the aim in milling was to pulverize the ore to pass not finer than No. 80 sieve.

Copper in Second Concentrate

At mill No. 2 the concentrate was clean pyrite with 15% silica and 0.5% copper of which about 6 lb. per ton was soluble in cyanide solution. It assayed $72 in gold and 67 oz. in silver. This when ground to pass 200 mesh and treated by agitation yielded 87% of the precious-metal contents, with a cyanide consumption of 20 lb. NaCN per ton. An extraction 1% better could be obtained by grinding the 200-mesh material to an impalpable mud. About 50% of the sulphide content of the ore was saved on the vanners and the remainder went over into the pulp.

An examination of the pulp residues showed that the concentrate in the slime filter cake had as low an assay value as that which had been ground to pass 200 mesh and treated separately with twice the cyanide strength and for double the time, while the coarser concentrate found in the sand residue showed only $2 per ton higher. These figures were confirmed in the laboratory by mixing ground concentrate with slime pulp and calculating the extraction on the former by a comparison of the residue assay of the pulp with that of a parallel test without the addition of concentrate.

COMPARATIVE COSTS OF SHIPPING AND TREATING CONCENTRATE AT MILL NO. 2

Shipping	
Freight and treatment	$12.45
Loss on gold, 1.5% and 67c. per oz.	3.41
Loss on silver, 5% at 50c. per oz.	1.67
Representation at smeltery	0.20
Sacks	0.75
	$18.48
Deduct, for excess of Fe	0.50
	$17.98

Treatment at the Mine	
Cyanide, 20 lb. NaCN at 18c.	$3.60
Precipitating, 61 oz. of bullion	0.42
Melting, 61 oz. of bullion	0.42
Express on 61 oz. of bullion	0.49
Loss in residue	13.50
	$18.43

The figures showed that a slightly better extraction was obtained on the concentrate when mixed with slime pulp and treated for 48 hr. with 0.2% cyanide solution than could be gotten by treating alone for 4 days with 0.5% solution. From this it was apparent that in the event of any cyaniding of concentrate being decided on, the method would probably not be by a separate treatment, but by circulating it through the tube mills and over the vanners in a closed circuit, until reground fine enough to pass with the ore pulp to the treatment tanks.

The assays of this concentrate are as follows: Head: gold $72; silver 67 oz.; value (silver at 50c.), $105.50. Residue:

gold, $9.10; silver, 8.80 oz.; value, $13.50. A comparison of costs, as between this method and shipping is given in the preceding table.

On the side of treatment no charge has been made for regrinding, because if returned to the general tube-mill system its presence would hardly be felt as an item of cost. Thus, there appears to be a difference of 45c. per ton in favor of shipping.

This being so, there remained the question whether concentration could profitably be eliminated entirely. Experiments were made on the same lines as before, working this time with concentrate taken direct from the vanners, without any regrinding. The result indicated that concentrate in this condition, if returned to the pulp and treated in the ordinary course, produced a residue of $19.18. This was much higher than when it was subjected to regrinding, but on the other hand the cost of concentration would be wiped out. A comparison between the alternatives of concentrating for shipment and abolishing concentration entirely, gave the following figures per ton of concentrate: Concentrating: Cost of concentration, $5.65; shipping charges and deductions as shown in the previous table, $17.98; total cost, $23.63. Not concentrating: NaCN consumption, 13 lb. at 18c., $2.34; precipitation, melting, and express on bullion contents, $1.33; loss in residue, $19.18; total, $22.85. This shows a loss of 78c. per ton on the side of concentration. The figures are so close, however, that we may say it is almost immaterial what course is pursued in the case of this concentrate.

Concentrate Treated Profitably at Third Mill

At mill No. 3 the concentrate is a clean pyrite with about 25% of silica. The assays follow: Head: gold, $1282; silver, 436 oz.; total, $1500. Residue: gold, $12.82; silver, 4.36 oz.; total, $15.

This material, when ground to pass 200 mesh and agitated with 0.5% cyanide solution for 5 days yielded 99% of its assay value, with a cyanide consumption of 54 lb. per ton.

A comparison between shipping and treating at the mine, showing costs per ton of concentrate, is given in the accompanying table.

In this instance the treatment at the mine indicated a considerable profit over shipment. It will be noted, however, that there is no charge made for redemption of plant, which would reduce the apparent profit to that extent.

The material at mill No. 4 was a pyritic concentrate carrying 30 to 40% silica and about 1% copper of which 12 lb. per ton was readily soluble in cyanide solution. The assays follow: Head: gold, $95: silver, 385 oz.; total, $287. Residue: gold, $1.55; silver, $4.98 oz.; total, $4.04.

This, when ground to pass 200 mesh and treated by agitation for 2 days gave an extraction of 98.5%, with a cyanide consumption of 90 lb. per ton.

COMPARATIVE COSTS OF SHIPPING AND TREATING AT MILL NO. 3

Shipping	
Freight and treatment	$51.00
Drying and sacking	4.00
Deductions in smelter settlement	50.00
	$105.00
Treatment at the Mine	
Grinding (estimated)	$1.00
Cyanide, 54 lb. KCN at 20c.	10.80
Treatment (estimated)	0.75
Precipitating and melting of resulting bullion	8.00
Shipping of resulting bullion	29.00
Loss in residue	15.00
	$64.55

Since taxes are included with other items on the "treatment" side, a tax charge has to be inserted on the "shipping" side also. In the other instances taxes are omitted from both sides, for the sake of simplicity. Here there is about $1 per ton shown to the advantage of treatment, but if we should write this amount off for redemption of plant the two sides would just about balance. The question of plant redemption will of course vary with the amount of concentrate made per month taken in conjunction with the estimated life of the mine.

COMPARATIVE COSTS OF THE TWO METHODS

Shipping	
Freight and treatment	$30.25
Drying, sacking and sacks	4.00
Assaying and sampling	1.00
Taxes	11.63
Smelter deductions	12.71
	$59.59
Treatment at the Mine	
Grinding (estimated)	$4.00
Cyanide, 90 lb. KCN at 17.5c.	15.75
Treatment (estimated)	0.75
Precipitation of 385 fine oz. at 1c.	3.85
Melting, at 1.2c. per oz.	4.62
Shipment charges, taxes, refining, etc., at 6.6c. per oz.	25.41
Loss is residue	4.04
	$58.42

In the foregoing tables, where considerable variations occur in the costs for the same items at different mills, it is due to local circumstances such as distance from railway, mule trail or wagon road, steam or electric power, etc.

Cyanide Consumption Important

It will be plain from the instances given that the subject of cyaniding concentrate must be studied in reference to each individual case, but some general considerations are here offered which seem likely to have more than a merely local application.

Leaving on one side the first two examples, as not affording much scope for discussion, let us look at the last two. On the side of "treatment" the item that first attracts attention will probably be the consumption of cyanide. Cyaniding of concentrates which yield a really high extraction is, not infrequently, prohibitive commercially on account of the excessive expense of the cyanide used and a substantial reduction of the same would often turn a loss into a profit. Among the several sources of cyanide consumption one only will be considered in detail here, and that is, combination with the silver.

The dissolving of large quantities of silver necessarily means a considerable expenditure of cyanide and this is where gold concentrates have a great advantage over those that carry a large proportion of their assay value in the form of silver. In the case of the latter, when copper and soluble iron salts are inconsiderable, the silver usually constitutes the principal source of cyanide loss.

Whatever theory be assumed for the dissolution of silver sulphide in cyanide solution, the final result is the formation of $KAg(CN)_2$, where silver and the equivalent of potassium cyanide are combined in the proportion of approximately 108 parts by weight of silver to 130 parts of KCN, or 1 troy oz. of silver to 0.082 lb. of KCN. If, then, this combined cyanide could be changed into available cyanide by some such method as precipitation by an alkaline sulphide the value of the cyanide so recovered might have an important bearing on the question of shipping vs. cyaniding. It was with this end in view that I made the following experiments and though no opportunity has as yet presented itself of carrying them out on a working scale, they are here given as suggestions and starting points for other workers.

Oxidizing Iron Reduces Consumption

Taking the case of mill No. 3, with a concentrate assaying in gold $1282 and in silver 436 oz. the cyanide consumption is given as 54 lb. KCN per ton. This figure, however, was not arrived at all at once, the loss at the beginning of the experiments being over 100 lb., 50 lb. of which went to the formation of ferrocyanide. This was remedied by making up the charge with water instead of cyanide solution then making it strongly alkaline with lime and aerating by means of an air lift for 48 hr. before adding cyanide, the result being, presumably, to oxidize the ferrous hydrate to the ferric state, thus rendering it less susceptible to combination with the cyanide. Under the changed conditions the solution showed only traces of ferrocyanide.

After the treatment by this method of a sample assaying in gold $675 and in silver 440 oz., which gave a residue of gold, $6.40 and silver, 3.68 oz., the silver in the solution was precipitated with Na_2S, and the increase in free cyanide determined by titration. The total quantity of cyanide originally locked up in the solution (reduced to pounds per ton of concentrate) was then accounted for

thus: KCN combined with gold (by calculation from the equation), 1.5 lb.; KCN actually regenerated by precipitation of the silver with Na_2S, as found by the difference in titration, 38 lb.; KCN combined as KCNS (by analysis), 8 lb.; total combined cyanide, 47.5 pounds.

The actual consumption shown was 53 lb. leaving 5.5 unaccounted for, probably representing oxidation products caused by the aeration. No copper was present and only traces of ferrocyanide.

For the extraction treatment the cyanide strength was maintained at 0.5% KCN, and the dilution at 5:1. No lead compound was added to the charge, and no zinc was present. The solution was not changed during treatment. The time of agitation was 4 days, and the combined extraction 99%. The cyanide theoretically needed for combination with the silver was according to equation, 35.8 lb. That the regeneration as shown by titration is greater than the amount theoretically called for is probably due to a slight over-titration and the multiplication of the error by five in reducing to terms per ton of concentrate.

Taking as a basis the equations,

$$Ag_2S + 4KCN = K_2S + 2KAg(CN)_2$$
$$K_2S + KCN + O + H_2O = KCNS + 2KOH$$

the amount of sulphocyanate theoretically required was 8.8 lb. per ton of concentrate, whereas the amount found by analysis is less than this by 0.8 pound.

Large Loss by Combination With Copper

Turning now to mill No. 4 with a concentrate assay of: Head: gold, $95, silver, 385 oz. Residue: gold, $1.55; silver, 4.18 oz. The cyanide consumption was 90 lb. per ton. The analysis of the solution showed: copper, 0.1%; sulphocyanate, (in terms of KCNS) 0.155%; ferrocyanide, trace.

The actual precipitation of the silver by sulphide was not made on this solution, but the amount theoretically recoverable according to the quantity of silver dissolved works out at 31 lb. per ton of concentrate. The ascertained cyanide losses therefore work out as follows: KCN combined with silver, 31.3 lb.; KCN combined as KCNS, 12.5 lb.; KCN combined with copper, 38.7 lb.; total, 82.5 lb. per ton of concentrate. The copper is calculated on the assumption that half is present as cuprous and the other half as cupric double cyanide. If the copper be assumed to be all in the cuprous state the figure for the combined cyanide would then be 25.8 lb. per ton.

In this instance the cyanide loss from other causes is largely in excess of that due to combination with the silver, so that a regeneration scheme which would recover only the latter cyanide would not show to such advantage here as it would in a case where the silver is the principal source of cyanide loss. Yet even here, when it is remembered that the cost of zinc precipitation is incidentally saved, the method would be well worth considering.

Under circumstances, however, such as those in mill No. 3, where a good profit is already shown on the side of treatment, a recovery of $6 or $7 worth of cyanide would be a welcome addition to the profit, so a few suggestions are given as to how this might be carried out on a working scale.

Regeneration by Precipitating Silver

In order to get a clean silver precipitate it would be necessary that treatment should be conducted with new solution each time so as to avoid the zinc which would be thrown down with it if stock solution were used, the treatment solution, after precipitation being added to the stock in the main plant.

It follows from this that the ratio of solution to concentrate should be as small as possible consistently with a good extraction, so as to avoid appreciably increasing the general stock in the main plant. I have found that with a ratio of 5:1 in the original agitation the maximum extraction can usually be obtained, without any change of wash, provided that the strength of free cyanide is kept up to the necessary point throughout the agitation.

Zinc Would Interfere

The difficulty of having to provide fresh solution for each charge might be overcome by precipitating the gold electrolytically instead of with zinc. In this case the same solution could be used over and over without fouling the precipitate of silver sulphide.

For agitation, an ordinary tank with mechanical stirrer and a small air-lift at the periphery for aerating, will usually be found much more convenient than a Pachuca, especially when the plan is to settle and decant. Not the least trouble is experienced concerning the sticking of the paddles if they are set sufficiently high above the bottom for the granular part of the charge to settle beneath them, the only other precaution necessary being to give a sufficient speed to the paddles so that they will pick up the charge again from the bottom. If these two points are observed devices for raising and lowering the paddles are quite unnecessary.

The most suitable filter would appear to be a horizontal vacuum filter, with sides 6 in. high, and arranged so that it might be tilted almost to the vertical for dumping the washed residue. A square or oblong table filter of this kind about 8x12 ft. would treat 500 lb. of concentrate at each charge, the pulp, solution, and water would be filtered to a finish in each case, and then the table would be tilted, the ledge on the lower side removed, and compressed air allowed to enter under the cake which would slide off towards the dump.

As soon, then, as treatment of the gold and silver is complete, the charge will be settled and decanted, the solution going to a special precipitating tank fitted with mechanical stirring gear. The thickened concentrate charge will then be stirred and sent to the vacuum filter to receive its washes, the original solution being added to that already decanted, and the wash (which might be plant stock solution) being run to the precipitation house of the main plant.

Sodium Sulphide the Precipitant

Returning now to the solution which was decanted from the finished agitation treatment, the agitator in the solution storage is set in motion, and a perforated box or basket hung therein containing commercial sodium sulphide. The solution is tested from time to time in a small flask with lead acetate, and sulphide is added to the tank little by little as it dissolves, until a faint coloration is seen on testing with the lead salt, indicating that soluble sulphide is in slight excess. At this point probably 98% of the silver will have come down; the remainder will not precipitate without a considerable excess of sulphide (varying as the strength of free cyanide present), and it would seem better to leave 1 or 2% of silver in than to be obliged to add lead compounds afterwards to remove the excess of sulphide and render the solution fit for re-use. If addition of sulphide is stopped when only traces of free sulphide are indicated the oxidation of the excess is so rapid that the mere fact of decanting from one tank to another is sufficient to remove all indications of it.

When precipitation has been carried to the desired point the agitator is stopped and the silver allowed to settle, and after decantation of the supernatant liquid, the precipitate is pumped into the cleanup press in the usual way. The product thus obtained is almost pure silver sulphide since copper and gold do not come down and zinc is absent unless dissolved out of the charge. It will be well to wash the cake in the press so as to remove the gold-bearing solution from the silver.

The solution decanted from the silver-precipitating tank is then treated by zinc dust or shavings, or by electrolysis, for the recovery of the gold, and in the first event run to the stock tanks of the main plant, or in the second, used for the next concentrate charge.

Refining of Silver Sulphide

The silver sulphide thus obtained might be reduced with litharge in a test furnace and then cupelled, which would probably be the most satisfactory way usually. As an alternative, however, some experiments were made in direct crucible melting, and after a number of trials in assay crucibles with various fluxes, it was found that, on that scale at least, a simple reduction with charcoal was quite feasible, the only essential being to add sufficient fluxes to form a good slag bath for the reaction to take place in. The crucible that gave the best result had the following flux: Precipitate, 50 grams; charcoal, 10 grams; borax, 20 grams; soda, 40 grams; sand, 20 grams.

This may seem expensive, but as there is practically nothing to flux off the slag should not get fouled and could be used over and over again. The silver button from this melt was white and soft with not even a skin of matte on top, but it assayed only 964 fine, with traces of gold due to insufficient washing of the precipitate. The composition of the impurity was not determined, but it may have been only finely divided carbon held mechanically in the metal. It would seem that this method might be developed where cupellation does not commend itself.

The cost of sodium sulphide will vary greatly with the locality of the mine and difference in freight charges, but would be considerably cheaper than cyanide under any circumstances. The quantity necessary would be 0.3 lb. of pure sulphide, or about 0.5 lb. of commercial fused sulphide, to recover 1 lb. of cyanide. It must be remembered in this connection that the cost of zinc precipitation of the silver is saved, which in some plants amounts to 1c. gold per fine ounce of bullion, and which would more than pay the cost of the sulphide.

The process here outlined has been actually carried out by me on batches of 400 lb. of concentrate, with the results described, and would seem worthy of further development. When other cyanicides are not present this would remove the chief source of cyanide loss.

Sources of Cyanide Losses

Other possible losses may be due to: (1) copper; (2) zinc; (3) formation of ferrocyanide; (4) sulphocyanate. In the case of copper there seems little to be done, since it does not precipitate from cyanide solutions with a soluble sulphide. In some cases it might help to give a preliminary treatment with sulphuric or sulphurous acid and thus get rid of most of the soluble copper before cyaniding. Or it is possible that one of the methods involving an acid decomposition of the solution followed by a regeneration of the cyanide might be feasible on such high-grade solutions as we are discussing.

Regarding ferrocyanide, a method proposed in the early days of the Rand, and since put into practice by the Goldfield Consolidated, consists in treating the charge with dilute sulphuric acid previous to cyaniding, to remove the basic ferric sulphate which is a fruitful source of cyanide loss, but when the concentrate is taken direct from the tables without standing in the air in a moist state for oxidation changes to take place, I have seldom found any tendency to a formation of ferrocyanide. In the one instance given, (mill No. 3) the placing of the concentrate without delay in a strongly alkaline water wash, and the giving of a thorough aeration by agitation before adding cyanide, almost entirely removed this source of loss.

The sulphocyanate which is always formed to greater or less extent under these conditions can probably only be decomposed and regenerated by electrolysis, on some such lines as those proposed in the Clancy process. Where zinc is dissolved from the charge the cyanide so expended would be regenerated in the precipitation of the silver, with the production of a proportionately lower-grade silver precipitate.

In regard to the determination of sulphocyanate in solutions resulting from the treatment of concentrates such as those that have been described, the presence of silver and copper interferes to such an extent as to make impossible the methods commonly recommended. I have found, however, that by the simple expedient of agitating with excess of zinc dust to remove either or both of these metals if present, and then filtering, the usual methods when applied to the filtrate will give close checks on "made-up" solutions. To remove the silver an agitation with zinc dust for a few minutes only is needed, but to obtain complete elimination of the copper it is safer to give from ½ to 1 hour.

To find ferrocyanide the only reliable method seems to be that of evaporating with acids, and titration for iron, assuming that all the iron present was combined as ferrocyanide. (See Clennell, Chemistry of Cyanide Solutions.) In conclusion it may be said that if by one means or another the loss of cyanide could be reduced to a reasonable figure, one of the principal obstacles to the profitable cyaniding of concentrate would be removed.

A promising discovery of tin in a formation of quartz porphyry is reported to have been made at Colebrook on the west coast of Tasmania.

Rio Plata Mining Co.

The fourth annual report of the Rio Plata Mining Co., giving the results of operating its properties in the state of Chihuahua, Mexico, for the year ended Nov. 30, 1911, states that four dividends of 2% each were paid to stockholders, amounting in all to $149,554. The earnings for the year were $410,996, the expenses $194,050, the net profit $216,946. The earned surplus at the end of the year was $192,139, after deducting dividends. The total amount of $22,500 was written of for depreciation. Another 2% dividend was paid, Dec. 29, 1911, bringing the total dividends paid to that date to $327,018.

During the year 9452 tons of ore containing 35.7 oz. of silver per ton was mined. The cost of mining was $2.24 per ton. The cost of milling and concentrating 8775 tons of ore and of regrinding and cyaniding 25,831 tons of old tailings was $5.10 per ton. The following are the details of milling operations for the year.

Ore delivered at mill, 8775 tons; average assay, 35.7 oz. silver; total contents, 315,462 oz.; recovered in concentrates, 87,469 oz.; tailings from concentrators, 8693 tons; contents, 227,994 oz.; average assay, 26.2 oz. silver; treated by cyanide, 25,381 tons of tailings; contents, 871,428 oz.; recovered, 759,229 oz.; extraction, 87.2%; total cost per oz. of silver recovered, 17.8 cents.

The property, on account of its remote situation, was not inconvenienced by the revolutionary disturbances, but shortage of labor was experienced. The results of development work were not satisfactory, the work having been in ore too low-grade to mill. For these reasons the reduction works was closed in January, 1912, and work will not be resumed until the rainy season, which begins in July.

By reason of the extent of the low-grade ore, the unprofitable ground encountered during the year, and the unsatisfactory political situation in Mexico, the directors considered it advisable for the company to acquire a mine in the United States. Accordingly a majority of the issued capital stock, amounting in par value to $900,000, of the Trinity Consolidated Hydraulic Mining Co., was purchased.

This new placer property is in Trinity County, California. Its capital stock is $2,000,000, of which $625,000 in shares is on hand in the treasury. The authorized bond issue is $750,000, of which $603,000 in bonds is in the treasury. The Rio Plata company invested the sum of $60,000 in these stocks and bonds and also made a loan of $50,000 at 6% interest for a period of six months on collateral security.

Baltic Method of Mining—I

By Claude T. Rice

The method of mining used at the Baltic copper mine in Michigan was necessitated by conditions peculiar to the Baltic lode in Copper Range Consolidated ground. The system includes mining on a waste filling, built-up dry walls and mill holes, underground sorting, and the mining of level pillars by "caving."

The mines with a comparatively flat dip, in the Lake Superior copper district, generally use an open-stope method of mining, while those of steeper pitch, excepting the Copper Range Consolidated mines, use ore-filled stopes. At the Copper Range properties, however, the Baltic system of mining is used, in which the mill holes and the walls along the levels are made by building a dry wall from the poor rock, and in which the miners rig up in the stopes on a filling of poor rock. This method has been adopted after trying other methods, and experience has shown that along the Baltic lode, in the properties belonging to the Copper Range, waste filling must be used to mine at a profit.

Old Methods Employed First

The Baltic, Trimountain and Champion mines were worked first in a manner somewhat similar to the Atlantic mine nearby. Stulls were placed along the level, the upper end resting against the hanging wall, and the bottom end in the ore, thus allowing a triangular opening sufficient for level purposes. The stopes were filled with ore, on top of which the miners rigged their machines, the excess ore being drawn off through chutes placed between the stulls on the level, at intervals of from 25 to 30 ft. The ore ran to a sollar about 3 ft. high, from which it was shoveled into cars. This method was employed at the Trimountain and the Baltic and was the one first used at the Champion, but it was soon decided that it would be better at the Champion to leave a pillar of ore above the level to protect the drift, rather than to place stulls which were expensive and consumed much time in lowering from surface.

This method was shown to be an improvement over the first one, but there were reasons why any such ore-filled method could not succeed in these mines. To understand this it is necessary to understand also the ore occurrence, which I will describe with some detail.

Manner of Occurrence

The Baltic, Trimountain and Champion mines extend along the Baltic lode for a distance of about four miles, with stretches of less promising but little prospected ground between. In this distance the Baltic lode makes a considerable bend to the south, shown by the fact that at the Baltic mine the strike is north 63° east, at the Trimountain, next, south, north 32° east, and at the Champion, next south, north 27° east. At all three properties the dip is approximately 70° northeast.

In some previous descriptions of the Baltic lode the mineralization has been ascribed to the fact that the ore occurs along a shear zone. It is true that there has been some fissuring of the lode parallel to the walls, but shearing has played a less important part than would be inferred from such a statement. In truth, the origin of the lode, in its essentials, seems to be similar to the other amygdaloid lodes of the district, being due to the mineralization of an amygdaloidal flow, more open than others nearby, owing to the shattering that it received during the folding that the flows underwent. I would attribute the manner of cooling as the reason for the localizing of this shattering, as numerous shrinkage veins were apparently developed; it was probably these jointings that made the flow the place of adjustment for the strains that were accumulating in that part of the Keweenawan series during the folding. In other words, the breaking-up of the lode, so as to offer a good channel for the mineralizing solution, was not due so much to a shearing action as to an opening of the flow along lines of weakness, the latter due to shrinkage from sudden cooling.

Ore Occurs in Patches

The ore in the Baltic lode, as in the other mineralized amygdaloids in the district, occurs in large irregular patches with stretches of poorer ground between. That these patches of poor ground should come in along the dip, just as at the surface they come in along the strike of the lode, is to be expected, and this is the history of the district. The Trimountain, after seven years of famine, appears to be entering a more promising ground under a poorer patch. Similar occurrences are not unknown; in the early life of the Quincy mine the lode on the ninth level was so poor that the mine was almost abandoned, and even on the Calumet & Hecla conglomerate, where the ore is more uniform in grade than in the amygdaloids, a great egg-shaped area of poor ground was found in the center of the Calumet & Hecla properties, and for a time was quite discouraging. In short, the ore occurs along the lodes in areas rather than in shoots. The grade of the ore is erratic in the interior of these irregular patches, and on the Baltic lode probably only about 60% of the area of such patches is of mineable grade.

View Showing Early Winter Conditions at Champion Copper Mine, Michigan

Characteristics of Baltic Lode

A noteworthy difference of the Baltic lode, as developed in Copper Range ground, and as contrasted to other amygdaloids, appears to lie in the large proportion of copper that occurs in good-sized bunches. This coarse copper appears to one going through the different properties of the district, to be larger in proportion to the total copper content of the rock than in other mines where the ore is of similar grade.

The reason for this is, that the Baltic lode is broken more by jointings than are the other amygdaloids. The copper made off from these fractures by eating its way out into the mass of the basalt rather than by hunting for preëxisting cavities, such as vugs and amygdules, or small openings in a rock matrix made porous by alteration. These small cavities in the massive rock were not especially numerous, and there is a large portion of the lode's cross-section that is absolutely barren. Most of the copper can be seen, and underground sorting can be done to advantage, by making the picker follow the rule of throwing into the ore mills, all rock showing copper, even if only a particle. The rock in the Baltic lode shows a pronounced tendency to break along planes parallel to the walls, and it is due to this characteristic that the poor rock breaks into the tabular boulders so admirably adapted to the walling system than is used in protecting the workings. Further, it is because the rock is little altered that it stands so well when built into walls, not shelling off under pressure nor crumbling, as does the poorer rock from the Baltic lode in Superior ground. Probably the width of the ore in the three mines averages about 30 ft., being much wider than the usual amygdaloids, this being due doubtless to the shattering of the mass of the flow. Large pockets of rich ore are found characteristically along the foot of the flow.

Considerable fine copper occurs with the coarse, and the recoveries at the mill show that approximately 15% of the copper yield will pass a 40-mesh screen; by this is meant copper metal and not mineral, the latter being the name for concentrates in this district. This occurrence of fine and coarse copper is so characteristic that larger pieces of lode material, which do not show visible copper, are thrown aside as poor rock for filling. The pockets that are apt to occur along the foot wall, where the walls have been fractured, often greatly increase the width of the ore. The greatest widths of the ore are found where strong cross-fractures have allowed the solutions to penetrate a considerable distance into the walls of the lode, and in places the ore width is 75 ft. These foot-wall pockets are often separated from the main lode by bands of poor rock, and are found in breaking into the walls to obtain necessary filling for the stopes.

The West Vein

A vein, called locally the West vein, parallels the Baltic lode in the hanging wall at a variable distance of between 50 and 60 ft. in these three mines. This flow in many places is more amygdaloidal than the Baltic, but apparently has not been broken so much. In Baltic and Champion ground it has produced much copper, but apparently only near places where rich areas have been found in the main lode. Such mineralization is due to cross seams cutting the main lode at those points, thus permitting the solutions from the main lode to enter the other amygdaloid, and apparently it is only under such conditions that ore is found in the West vein. The stopes in the wide, rich portions of the main lode are those that are most short of filling, and it is at these points that ore is most likely to be found along the West lode and consequently crosscuts are generally driven to the latter amygdaloid. Since there is a possibility of finding ore at any point in the West vein, the practice, when poor rock from the main lode is insufficient, is to take a shallow slab off the foot in search for a pocket along that wall, and then to crosscut to the West lode.

West Lode Barren at Trimountain

The mining captains are inclined to believe that the filling which comes from the walls of the lode is paid for by the profits on the copper that is found in this way. In the Trimountain mine no copper has yet been found in the West lode, although the latter has been opened at many points. In that mine, therefore, no crosscutting to the West lode is done in the stopes, but the filling is obtained principally by slabbing off the foot wall, as it is there that unsuspected pockets of ore are most likely to be found. As regards the amount of copper found in the foot-wall pockets, the Baltic resembles the Osceola lode more than any of the others north of Portage Lake. In the Baltic mine there are small stretches of the lode that are much altered, and the walls here are quite weak and break readily when exposed. In general the walls of the stope stand well when not broken into; once broken into, the hanging wall is generally stronger in this respect than the foot wall. The wall rock of the lode drills generally with a redder sludge than the ore does, often beyond a soft wall of such red-drilling ground, pockets of good ore are found in both the foot and the hanging walls of the main lode.

Chalcocite Veinlets Characteristic

The true veinlets of chalcocite, locally called copper ore, that are found along the Baltic lode are a noteworthy feature. Calcite generally occurs with the latter, and in places I measured solid chalcocite 2½ in. wide; it is said that occasionally veinlets of solid chalcocite 5 in. wide, have been found. The veinlets can often be traced for several hundred feet, running true with the vein until cut by some cross fracture; they are often used by the mine captains to find the lode, when the latter has been lost owing to a barren patch. The true significance of this chalcocite has not been shown, but the amount is quite appreciable as shown by the noticeable streaks on the tables at the mills. There seems to be less of it in the Trimountain than in either the Baltic or the Champion mines.

The Baltic lode is broken by cross fractures at many points, and these seem to be of two characters. Some apparently were prior to mineralization, for the ore solution made off along them into the West lode to form pockets; others have displaced the lode 20 to 30 ft. at places. Some other breaks seem to have had little effect in throwing the lode; on one side of them much copper is often found, possibly owing to the lode on that side having been broken more by fracturing, while on the other side there will be noticeably poorer rock. Fingers of good ore occasionally make off for considerable distances into the foot wall, but it seems that the hanging-wall branch, no matter what the relative size of the two at the point of dividing is, is always the real lode. Often in the stretches of poor ground that separates good patches of ore in the interior of the larger areas, it is quite difficult to determine what is really the lode; whenever a chalcocite veinlet can be found, however, all doubt is removed.

The direction of displacement varies greatly, and there is no rule to follow in finding the lode again. If the displacement has occurred in poor ground and there is no chalcocite or calcite veinlets, identification is not an easy matter. The ore in a stope will often make out over a poor stretch on a level, but the fact that poor ground has been found on one level is no reason for supposing that this will be the case on the level below in that part of the mine, for the poor rock generally occurs in patches bearing little relation to one another.

Owing to the fact that the mass of the lode is not badly altered, the ore itself stands much better than the walls. Con-

COST OF BREAKING GROUND IN COPPER RANGE SHAFTS

Mine	Baltic				Champion	
Size of shaft	24x10 ft.		18½x10 ft.		20x8 ft.	
	Per Ft.	Per Ton	Per Ft.	Per Ton	Per Ft.	Per Ton
Drilling labor	$11.52	$0.576	$ 9.04	$0 586	$8.41	$0.632
Explosives	2.16	0.108	1.64	0.106	1.22	0.091
Total breaking costs	$13.68	$0.684	$10.68	$0 692	$9.63	$0.724

siderable time is taken up in barring down the back before the miners are able to set up a machine because the copper rivets the ore together and holds the slabs up even when the latter have been cut off by a strong crack. Cross-seams of laumonite and calcite, cutting across the lode, are apparently less common along the Baltic than in the Kearsarge and Osceola lodes; for this reason the ore is less treacherous in the stopes, although none of the copper-country lodes are especially treacherous in this respect. It is generally either the hanging or the foot wall that slabs off. For this reason it is quite common in the Baltic mine to leave a slab of poor ore along the hanging wall to support the arch of ore in the stope. In fractured places along the lode the workings, in this way, can be made more safe than if the walls of the lode itself were exposed.

Difficulties in Stoping With Ore Fillings

The ore-filling method of stoping has proved quite satisfactory for mining lodes of high dip, such as the Isle Royale, Pewabic and Atlantic amygdaloids; in these the mineralization was confined more to the upper and more open part of the lode, the ore does not make off so much into the hanging wall, and the stoping widths are less. It can be easily seen upon consideration, however, that under the conditions found at the Baltic a method of ore-filled stopes was not destined to prove especially satisfactory. In fact the weaknesses of the old system soon became evident.

When the ore was drawn from the stopes after the latter had been carried up to the level pillar above, it became evident that there was still much ore left in the walls, notwithstanding that the pockets had been extracted as far as possible. This was due to the fact that the ore filling had to be carried close to the back in order to protect the walls from any slabbing tendency. Therefore, there was not much of the walls exposed for inspection after a breast of ore was broken down; and it was not until the stopes were being drawn that indications of many pockets appeared. A good many of these pockets along the foot wall were worked out while the ore was being drawn from the stopes, but it was a dangerous task for miners to work in a stope with a large breadth of unsafe hanging wall exposed above them. The walls slabbed off to some extent even when not cut into; once broken by mining out a pocket, this slabbing became more pronounced, rendering the securing of other pockets still more dangerous. It was also impossible to draw the ore from some of the stopes where the hanging wall was especially weak, and it was evident that some support to the walls was necessary. The main reason for abandoning the method of mining on a filling of ore, was that the grade coming from the mine was much lower than it should have been from the appearance of the lode in the different stopes. This was due partly to admixture of wall rock, but mainly because the mass of the lode, which itself was little mineralized, had to be drawn off from the good portions adjacent to the fractures. As a result the mines were soon making scarcely any profit, and a change was forced upon the company.

This change was made first at the Baltic property where F. W. Denton, the present manager of the Copper Range group of mines, was in charge. But even before the Champion and Trimountain mines came under his control, through a consolidation of the three properties, changes had been introduced at those mines also. Mining on a filling of ore in this lode, which was so admirably adapted to underground sorting, was proving disastrous at each property. It was decided to mine out the ore on a filling of waste, as this would also allow the pockets of ore, that made off into the walls, to be mined more safely.

Development of the Waste-filled System

At first the levels were protected with drift sets, and the ore was taken from the stopes through cribbed chutes. These were made in the form of a pig-sty 5 ft. square, from 7-ft. logs, each log being notched slightly on the upper side to receive the next log. These cribs were first placed about 35 ft. apart; when the distances became too great for loading the ore directly into the mill, wheelbarrows with flat platforms carried on handles swung from below the axle were used, in order to allow boulders of ore to be rolled on them easily. Because of the cost of maintaining the cribbed mills, the distance between them was soon increased to 50 ft., and the wheelbarrows were replaced by small cars running on a track.

Mining on a waste filling had not been in practice long when John Jolly, the present underground superintendent of the Copper Range mines, and then one of the under-captains at the Baltic, suggested that dry walls built out of poor rock be used to protect the levels. These stood well, and in the hope of decreasing the cost of maintaining the cribbed mill holes, it was decided finally also to try to build them from the larger pieces of poor rock. Before cribbed mill holes were done away with, their cost at the Baltic mine alone had increased until it was $1200 per month. These dry walls have been used ever since, as it was found that no more labor was required in building them than when the cribs were in use, owing to the great amount of constant repairs on the latter. Several savings were effected, including the cost of the timber, the elimination of the cost of getting the timbers underground, and the consequent decrease in the ore-hoisting capacity of the shaft.

The Baltic System of Mining

The final innovation was the mining of the pillar that formerly had been left in the higher dipping lodes, to protect the level, to support the walls and to hold back the waste that was later dumped into some of the stopes. It was this practice, locally called caving, that Mr. Denton devised, and it was this step which finally made the Baltic method complete. The carrying of the stope on a filling of waste, with dry wall drifts and mill holes, together with underground sorting and the mining of the level pillar by the system called caving, makes the Baltic method distinctive from other waste filling systems. Underground sorting resulted in a better grade of ore hoisted and sent to the mill, and the Baltic soon became one of the lowest cost mines at the Lake.

The three mines are opened with shafts sunk at approximately the dip of the lode, but some of them were started with too flat a dip and have gone into the hanging wall. This is true at the Champion and the Trimountain mine. At the Baltic the shafts are in the foot wall or the lode itself. In all cases the shaft is near the vein and at no place more than 30 ft. in either wall. It has not been thought wise to steepen the shaft now in the hanging wall, as other lodes in the district have been found to flatten appreciably with depth, and it might necessitate a second curve at a greater depth, thus possibly affecting the hoisting efficiency.

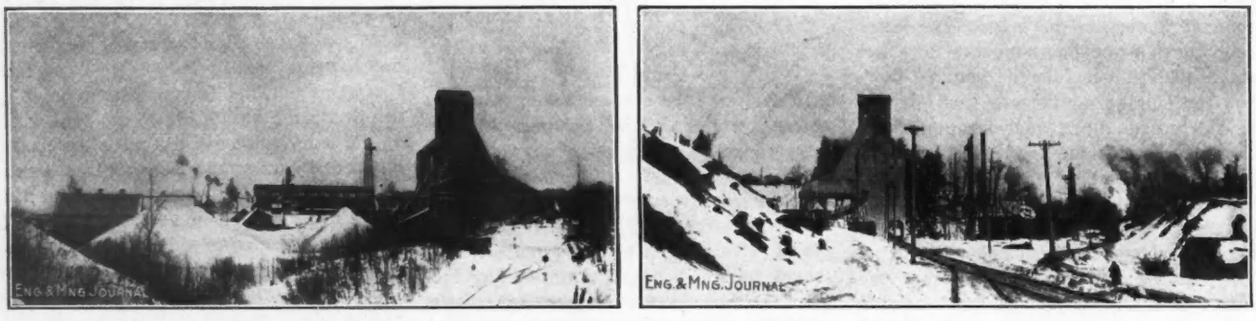
Arrangements of the Manways

The Champion shafts have their manways at the south end of the shaft; in the Baltic the manway is always placed in the center between the two skip roads, and at the Trimountain some of the shafts have the manway in the center and others at the end. In these steep shafts, dipping at about 70°, it is more convenient to have the manway in the center; it is easier to make repairs and to inspect the rollers, and it is also safer, as in case a skip jumps the track there is little danger of its causing a wreck in the other compartment. To facilitate working, it is important also to place the manway in the center of the steeper shafts; this is not so necessary in the flat shafts where a man can walk up and down.

Most of these shafts have to be sunk through considerable overburden, and one at the Trimountain went through 150 ft. of wet material. This was done by

sinking a small one-compartment shaft near the site of the larger one. In cases where the shaft had to go through only a short thickness of overburden, this was done without great trouble by putting down a cribbed shaft much larger than the section of the incline shaft; after this a tight seal was put in at the solid rock, and either a concrete collar, or in still earlier days the cribbing for the regular shaft, was carried up, and dirt was filled in around the timbers as the shaft was raised.

Baltic shafts Nos. 3 and 4 have their manways in the center, 10 ft. wide, so as to give ample room for an auxiliary cage in that compartment, in addition to the pipes and ladderways, in case such procedure becomes desirable when the mine is deeper. In the other Baltic shaft the manway is only 4 ft. wide in the clear. In all the Baltic shafts the skip compartments are 6 ft. wide in the clear, as the skip tracks which are carried on wood stringers imbedded in a continuous stringer of concrete, are put in with standard gage, 4 ft. 8½ in. This makes the larger shaft 24x10 ft. in the clear, and the smaller ones 18½x10 ft. The Trimountain shafts are 20x7 ft., and at the Champion 20x8 ft., inside measurement. Regular shaft sets, carried by hangers from bearer sets, are used only where the ground is bad, and these shaft sets are planed from 12x12-in. timbers, the wall plates consisting of one piece. The stations are carried on 10x16-in. timbers. Where the shaft rock is good, only dividers of 10-in. flat timber are used, carried in hitches both in the foot and hanging. The practice at present at all the shafts, however, is to use concrete wherever the shaft walls are at all bad; the only timber that is now being placed in the shaft are the stringers that carry the rails of the skip roads in the concrete, and the casing planks between the manway and the skip compartment. Consequently the lower parts of the shafts are almost completely fireproof.



SHAFT E AND SHAFT B, CHAMPION COPPER MINE, MICHIGAN

METHOD OF SINKING

The shafts have all been sunk by means of buckets and trolleys traveling on an overhead cable. It is the practice to anchor the eye-bolt, to which the track cable is fastened, in the drill hole, with a wedge driven into a split in the bottom of the bolt; this is to prevent the eye-bolt from pulling out in case it should bend. At present the shafts are sunk in 200-ft. lifts. After this the concreting and the stringers for the permanent skip tracks are put in. In the shafts where the manway is only about 5 ft. wide, the hoist used in sinking, which in many instances is now an electric-driven, geared hoist instead of the usual air-driven puffer, has to be set up in back of the station of the top level of the lift, the station being enlarged for that purpose. However, in the Baltic shaft with the large manway compartment, the sinking hoist is set up in the manway itself. On nearing the station the bucket skids up a case-way, occupying the upper third of about one-half of the manway compartment. At the top the bucket swings back over the bins occupying the space under the bucket-way and is dumped into it; after this the rock is drawn from time to time, through a door in its side, into the skip and hoisted either to the surface or to the underground, poor-rock dump. This is better than the other method, in which the buckets must be dumped into a car and the rock stored on the level until a skip can be obtained. The shafts are sunk from 45 to 55 ft. per month according to the size of the shaft and the character of the ground. Whether the cut is taken at the end or in the center of the shaft depends partly upon the shape of the bottom and partly upon whether the manway is in the center or at one end of the shaft; it is the practice to try to take the cut or sink under the manway, whenever possible, so that the buckets can set in the sink when the shovelers are mucking out the dirt.

Two 2-man machines are used in the shaft, and the drilling and timbering is done on day shift, the shovelers cleaning out the shaft on night shift. In the Trimountain shafts it takes from 30 to 35 holes to square a cut, and about 6½ ft. of advance are made at a square. Four holes are required in the cut row, and also in each of the rows for squaring up the ends of the shaft; in most of the other rows three holes are sufficient to bring the ground. The miners blast each shift and on night shift the shovelers, three or four in number according to the amount of rock broken, send up from 30 to 50 tons, as each shoveler will ordinarily clean up from 12 to 13 tons of rock in a 9-hr. shift. These shafts are dry and there is little water to contend with; what little there is goes up in the bucket with the rock.

COSTS

In the Lake copper district it is the custom to keep only the cost of breaking the ground separately under the shaft-sinking account, and so I shall give those figures, which are accurate; but they cover only the actual cost of labor and supplies for breaking the rock in the shaft and do not cover the cost of mucking, hoisting, timbering and other such items. This holds true of all development statements made in company reports from Lake Superior copper mines unless otherwise specified, and the reader should remember this. The total cost of shaft-sinking is about $35 per ft. at these mines for a 20x8-ft. shaft, such as those at the Champion mine, taking in all expenses including the putting in of the concrete skipways. The actual breaking costs are given in an accompanying table.

TWO CROSSCUTS TO THE LODE

The roof of the shaft would be greatly weakened if the ground at the station were broken out across the whole width of the shaft, especially those of the Baltic having the wide manway compartments; for this reason the practice was adopted at the Baltic of cutting out only in front of the skipways and of driving two crosscuts from the shaft to the lode, leaving a pillar between to help strengthen the roof of the shaft at the level stations. This seems to be good practice and has been adopted also at the Champion mine. The front of this pillar is strengthened with a column of concrete to keep it from shelling off where it overhangs the shaft; in the Champion mine, one of the pillars, all of which are left much narrower than at the Baltic because the manways are

at the ends of the shaft, was crumbling away and the whole pillar was taken out and replaced with concrete.

Skips of two sizes are used in the different mines, the larger one holding five tons or two cars, and the smaller one 2½ tons or one car. The policy is to have small skips in the outside shafts and large ones in the central shafts, where most of the ore is hoisted. Where the large skips are used, the hoisting engines are practically all Nordbergs, having a double-cone drum with a diameter at the cylindrical portion of 18 ft. and a small diameter at the conical ends of 12½ feet.

No chairs or gates are used in the shaft, owing to the trouble that comes from their being broken through carelessness in letting the skip down on them. Moreover, it is better for the hoisting rope if the dumping is done with the load on the cable. In the case of the 5-ton skips and owing to the stretch of the cable, this requires that the skip be raised each time, as it would be dangerous to dump the second car with the skip much below the station; rock might be spilled into the shaft during the dumping. This is one of the dangers of dumping cars directly into the skip and is one reason that the manways are covered so carefully with a trap door at each level. In the mines with a flatter dip aprons are used to help in keeping the rock from being spilled during loading, but in some ways these are equally dangerous. A hood arrangement on the skip is being experimented with in models at the Copper Range mine, and it is hoped to develop a method of eliminating this danger.

Distance Between Shafts

The shafts are sunk quite near together because tramming is done almost entirely by hand. This is quite an advantage in the early life of the mine as it allows the property to be opened rapidly, thus enabling the management to see what really is in the ground; however, when it comes time to install the permanent equipment such as rock houses, hoisting equipment, etc., it seems time to abandon some of these shafts, for the surface equipment at a Lake Superior copper mine, taking in the cost of the rock house, boiler house and large, double-cone hoist, is heavy. There is, however, the advantage of the excellent ventilation which prevails through all the mines of this district, except where the latter are over a mile deep on the incline. There is little doubt that this is due mainly to the nearness of the shafts.

The maximum distance between shafts at the Baltic mine is 1170 ft., that being the distance between Nos. 2 and 3 shafts, while No. 4 shaft is only 900 ft. west from No. 3, and No. 5, 855 ft. from No. 4. The distance between C and D and between D and E shafts at the Champion is 1300 ft., and B shaft is about 1050 ft. from C. At the Trimountain the shafts are about 1000 ft. apart, and the policy has been begun of increasing the distance between shafts, as No. 1 shaft has been abandoned.

Electric Haulage

Electric haulage is being tried on three levels of the Baltic. While this is apparently resulting in some decrease in the tramming cost, it is hard for the management to ascertain the exact amount of the saving effected. The great advantage is the fact that a greater distance between shafts is permissible. At the Baltic where the electric haulage is used on the 17th, 18th and 19th levels and the ore is hauled to the two central shafts, the men running the trains work in two pairs, and they go up from one level to another. One man loads from a chute on each side of the shaft. When his cars are loaded a man goes to the station, gets the locomotive, which is always left there when not in use, pulls his train to the station, takes his empties to the mill and brings the motor back to the station again, while the other man is loading the cars of his train. No ore is hauled on night shifts, but instead the ore is allowed to accumulate in the mills on the levels where electric tramming is used. Ten 2½-ton cars are hauled in a train.

At the Quincy electric haulage has shown itself an economy, but at all the mines in the copper country there is the scattered condition of the working faces to contend with. As a result there is a comparatively small tonnage coming from each level at most of the mines. In a way this scattered working of the mine is obligatory in order to keep an even grade of ore going to the mill, for the grade of the ore in a stope is apt to change quite suddenly in a short distance, and the average can only be kept from fluctuating by scattering the machines in the hope of not having them get into low- or high-grade ground at the same time. Further, in order to keep reserves well ahead, in these mines where the grade of the ore is at the best only a shrewd guess, it is necessary to keep much more ground open than in the West, where the ore is in shoots, and the grade can be determined with some assurance. It is almost always necessary to have several machines on development work, and these would probably be scattered over four or five levels, so that it is next to impossible to concentrate the work on a few levels as in western practice.

Track Gage and Cars

The tracks on the motor levels have a gage of 2 ft. and are put in with a little grade, but on the other levels the grade is 3 in. in 100 ft., as the cars are fitted with Peteler axles and bearings and are self-oiling. These cars are long and low, as is characteristic of Lake Superior practice, and have one end open so that they can be raised up at one end, a brace put under them and the boulders rolled in. A rough wall of boulders is piled in at the end to hold back the fine dirt.

The distinctive features of the cars used in the Copper Range mines are the axles, which are fastened tightly to the truck so that a cradle has to be used to dump them, and the narrow gage of 2 ft. The low grade of 3 in. in 100 ft. can be used because of this narrow gage, the fact that the wheel base is only 24 in. and because the wheels are self-oiling. In hand-tramming the men work in pairs. In some shafts regular dumpers, generally three in a crew, but sometimes two, do the dumping, but in those shafts where less ore is being hoisted, the trammers do their own dumping. This tramming is done by the men working in the drifts and cutting out stopes on each level, and the men in the regular stopes do not have to come down to run their dirt.

At the shaft a side track about 60 ft. long, on which the empties can be stored, is put in, while on the electric-haulage levels at the Baltic, a double track is carried through the station and out a considerable distance to each side of the shaft. This extra track is used for the storage of empty cars. Turntables are put in on the track opposite each skipway at the station. These are not equipped with ball bearings, as is the case at some of the other mines, but instead the tables turn on a flat ring that is kept well greased. On the trolley levels the turntables are kept locked, but where hand tramming is used no catch is required to hold them in position.

A bell cord is used for all signaling to the engineer, although practically all the underground stations are equipped with a Carlson-Stromberg telephone, so that in case anything unusual is to be done the engineer can be told through the telephone.

(*To be continued*)

A Roman Iron Slag

The department of the Yonne, France, is said to be thickly dotted with Gallo-Roman slag piles. A sample from one of these, near the forest of Alliant, said to contain about 300,000 metric tons, ran as follows (*Echo des Mines*, Feb. 15, 1912): Fe, 46.69%; SiO_2, 27.44; Mn, 2.4; CaO, 0.30; S, 0.027; P, 0.072. No trace remains of the workings from which the ores were taken. These slag heaps have a present value as a flux for the limey ores of Lorraine.

Modern Gold Dredge in Georgia

By L. M. Richard*

Interest in the advancement of dredging and the application of modern dredges to the Georgia deposits in the old Dahlonega district is apparent in the completion and operation of a modern California-type dredge on the Chestatee River. This stream, in the past, has played an important part in the history of dredging in Georgia, and has been the scene of various endeavors with the smaller type of dipper dredge. It is reported that the first gold dredge erected in the United States was operated on this river, such names as F. G. Benham, Burch brothers, Captain D. Ingersoll and F. Jacquish being linked inseparably with dredging in this notable stream.

The geologic relationship of the section is not different, in any marked degree, from the general conditions existing in the upper auriferous belt of the Southern Appalachians. The rock formations, for the most part, are made up of schists and gneisses. The orebodies are composed of innumerable quartz stringers, termed by Becker[1] "stringer leads," and are closely allied with the schists. The small quartz seams are, with few exceptions, conformable to the schistose cleavage. It is these veins which have contributed the most gold which is found in the valley floors. The larger and thicker bodies of quartzite material to be found in the south rarely carry sufficient gold for treatment by milling.

The region through which the Chestatee flows shows evidence of having been subjected for a long time to conditions favoring subaërial rock decay and denudation. The opportunity for deep cutting and further erosion and transportation of the decomposed mantle to the rock floor below is excellent on account of the climate and the excessive precipitation. For many miles the Chestatee cuts through this belt, and with its upper tributaries has been for over 75 years the natural and much used drainage medium for the placers.

Dredge on Chestatee River

About four miles southwest of the town of Dahlonega, Ga., on the Chestatee River, is a Bucyrus dredge, built to design for the Seawell Dredging Co. This is a 3-cu.ft. bucket-elevator, 70-bucket Bucyrus dredge, equipped with hopper, shaking-screen tables, belt conveyor and standard gold-saving tables. The dredge is electrically driven, the total power being 125 hp. The dredge has a maximum yardage capacity of 4000 cu.yd. per 24 hours.

The hull was built on the shore in a pond which was dug for the purpose and filled with water from a nearby stream. It is constructed of the best quality of Georgia pine, selected with care to serve the purpose. The gantries and housings are substantially made and the hull is extremely well braced to take care of all strains. The buckets are made of cast steel, to which are riveted the manganese-steel digging lips and the base for mounting on the chain. The digging ladder is of truss construction, made entirely of steel and well designed. All tumbler bearings are of manganese steel, as well as the bucket pins which have withstood severe usage.

The disintegration is done on two large suspended shaking tables being moved by eccentrics on the same shaft, thus avoiding the use of gears. This mode of disintegrating and separating the fine from the coarse gravel is found to be successful when the wash water is effectively applied. These shaking tables are 5½ ft. wide and have a combined length of 24 ft., with perforated-plate bottoms, the holes running in size from ⅜ to 7/16 in., excepting the first section, which has bars instead of plate metal spaced ⅝ in. apart, running longitudinally with the screen at the lower end of the last section. These screens are run by a separate motor.

The gold-saving device is fitted with boxes beneath the screens, which are riffle lined. The side riffles are each 32 ft. long and 3 ft. wide, fitted with Hungarian riffles, which have been found exceedingly simple and effective. The material, after passing over these side riffles, follows out into the tail sluice, which is covered with cocoa matting, on which is a covering of expanded metal. This sluice is 25 ft. long.

The tailing stacker carries a Robins belt conveyor 70 ft. long with a 26-in. belt. This is mounted on a truss, composed of I-beams. The belt is driven by a separate motor. The discharged wash gravel varies in size. The screens, swinging which, digging buckets and high- and low-pressure pumps are each separately and independently operated by motors. The electrical energy used on the boat is supplied by the Gainesville Railway & Power Co., from its hydro-electric plant at Newbridge, 4½ miles from the dredge. The initial current leaving the generating station is a three-phase alternating current of 12,000 volts, which is stepped down at the boat to 440 volts. From the transformer house on the shore the energy is taken on the boat by means of flexible weatherproof cables. Considerable line loss is encountered here even with the best of care.

Heavy Clay Overburden

The average yardage being treated per month at the time of my visit in October, 1911, was from 30,000 to 40,000 cu.yd. The capacity was materially cut down on account of a heavy overburden of stiff, red clay, which it was almost impossible to disintegrate and dissolve thoroughly. No disposition is made of the black sand, which amounts to approximately 1% of the total gravel removed. It carries gold ranging from $3 to $6 per ton. Zircon, rutile, ilmenite, monazite, garnet, spinel are some of the heavier materials accompanying the black sands. These are not saved.

A 3-cu.ft. Bucyrus Dredge on Chestatee River, Georgia

Twelve transformers being built by the General Electric Co. are of interest on account of their size (*Elect. Rev.*, Feb. 17, 1912). They each occupy a floor space, 5x11 ft., and are 19 ft. high. They are 60-cycle, 3000-kw., for Δ-connection on a 140,000-volt transmission line; each contains 4000 gal. of oil, and they are to stand a test of 280,000 volts from the high-tension winding to all other parts.

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[1]Sixteenth Annual Report, U. S. Geol. Surv., 1895, p. 294.

Zinc Smelting in Kansas and Oklahoma

By A Smelter

An enumeration of the works in operation in the natural-gas fields, with brief descriptions of the equipment of each, and some remarks respecting their metallurgical practice and the subject of fuel supply.

The transition of the zinc smelting industry from the coal fields to the natural-gas fields, during the latter part of the '90's, marked an epoch in that branch of smelting, which up to that time had not taken its position among the other branches of smelting. It is now one of our most important arts in the making of metals.

Formerly zinc was almost universally smelted in the coal fields irrespective of the distance from the ore supplies, the cost of fuel far offsetting that of the cost of the freight on the ore, owing to such large quantities of the former being required. The zinc smelters west of the Mississippi River in many instances were given their coal (slack) free of charge; a small charge only was added to cover the cost of loading, screening, etc., which added to the freight made the cost very low. At this period there was no large demand for this class of fuel, and many coal companies were glad to offer inducements to smelteries, simply to get rid of it. With the introduction of machinery to handle this character of fuel for firing, etc. in large steam plants, it became to these coal companies a source of much revenue, rather than a loss.

The discovery of natural gas in Kansas came as a welcome source of the best fuel to be had for the heating of zinc furnaces, and it had the fine advantage of being near to both the zinc-ore fields of Missouri and the coal fields of southeastern Kansas where existed the large beds of the "dead" coal so necessary as reduction material in the smelting of zinc ores. The first smelters to take advantage of this cheap, and to them, new fuel, were some of the Lanyons, who built works at Iola that were subsequently taken over by the Lanyon Zinc Co.

Gas leases could then be obtained at Iola, for 10c. per acre a year and $100 per producing well. These first wells "came in" with an average of 8,000,000 cu.ft. per 24 hours, and with an average rock-pressure of 350 lb. Being inexperienced with this fuel and not realizing the shortness of its life the smelters did not take any steps to conserve the supply.

General Practice

Between 1897 and 1903 the following concerns operated in the Iola field: Lanyon Zinc Co., two plants; United Zinc & Chemical Co.; Prime Western Spelters Co.; and Cockerill Zinc Co. In speaking of the Iola field, or district, it is to be understood that this takes in not only Iola but also Gas City, East Iola and La Harpe. The furnaces erected were all of the Belgian type, Iola style, this being a long furnace, of three or four rows of retorts in height, with forced draft, the gas and air being introduced through the front of the furnace.

About this time the Lanyon Zinc Co. became involved in a suit with the patentees of the Brown roasting furnace, which suit lasted many months and was finally decided adversely to the Lanyon company, which then adopted the Zellweger furnace, now in general use by all the western zinc smelters, the Edgar Zinc Co. excepted, which continues to use the Brown furnace whereof it holds patent rights. Retorts were made by the auger machine and condensers by hand. The ores smelted were the soft Missouri sulphides and silicates, except that the United Zinc & Chemical Co. was even then using largely of western ore, making sulphuric acid as well as spelter. These works continued in constant operation during the years mentioned and were discontinued only when the gas supply began to fail.

The Cherryvale Works

S. C. Edgar, of the Glendale Zinc Co., operating zinc smelteries at St. Louis, Mo. for 28 years, realizing the immense advantages of natural gas, entered the field at Cherryvale, Kan., where today his company, the Edgar Zinc Co. has one of the best equipped zinc works in this country. This company has about 25,000 acres of gas lands and leases in a territory relatively free from competition. Mr. Edgar employed the late John C. Dods to erect his works, embodying many ideas gained during his long experience, these works now comprising 4800 retorts. Double circular Brown furnaces are employed for roasting. At this period it was generally believed that natural gas could not be used in a zinc furnace in any way but with forced draft (although natural-draft furnaces had previously been used in Indiana). After some experimentation Mr. Dods evolved a furnace that could be fired with gas at 4 oz. pressure and with natural draft. This furnace was not only economical of fuel but also yielded a higher percentage of metal extraction than any furnace previously erected in the gas fields. The Edgar furnaces are strongly built, having perhaps twice the material of the ordinary distillation furnace, and some of them have been fired for as long as five years without "dead-firing" for repairs. Being constructed with high combustion chambers and being otherwise arranged differently than the usual practice, coal or any other fuel may be used in the future without any change in the form of the furnace.

The Edgar furnaces are 5 rows high and 20 rows long, thus making 100 retorts per side, or 200 per furnace. They are built in these small units to enable them to be "dead-fired" at any time or to be repaired without shutting off a great number of retorts. Each building contains three of these furnaces having 200 retorts to a furnace, making 600 retorts to a building and there being eight such buildings in the plant, there is a total of 4800 retorts. The furnaces are separated from each other by about 14 ft. from end to end and all piping, etc. is independent for each furnace. Spelter is drawn by an original design of "draw-car" and "shield" combined, which is passed along the front of the furnace by means of a sprocket-gear attachment The ladle is of a capacity of about 350 lb. and when drawn full is moved along the front of the furnace to the end, where at right angles to the ladle track, the molds stand waiting on a movable track. One man does all the work of drawing and pouring and the great amount of exertion that used to attend this operation is eliminated.

The retorts are blown out by means of water as is now the usual western practice and the old residues are dropped into the cellar through the ash hole in front of furnace, being removed from the cellar in the usual manner.

Oil Used in Roasting Furnaces

The Edgar Zinc Co. is experimenting with oil as fuel and no doubt remains that when the gas is exhausted this plant will be operated by oil. The roasting furnaces are all of the Brown circular type, except that one now in construction is of the straight-line type, 270 ft. long and 14 ft. hearth wide, inside. The new furnace is connected with a 120-ft. Weiderholt reinforced tile chimney. All of the roasting furnaces are fired with oil, which has been found to effect a saving over gas, as all machine kilns for roasting zinc ores are large consumers of gas, using indeed more

than the distillation furnaces. The results obtained as to sulphur driven off are better with oil than with gas, the oil seeming to give a more favorable heat. Less than 0.5% S is returned by these kilns from ores carrying an average of 4% S. By conserving the gas for use with the distillation furnaces only this company has assured itself of a long supply from its extensive holdings.

Mr. Edgar introduced into these works the first mechanical mixing house used in this industry in the United States. In this house all the charge is mixed the day before using, each furnace having its own bin wherein charge of any kind different from the others may be mixed without interfering with the other furnaces in the least. All of the material used is passed over scales and a very close record is kept of this work. A large concrete building houses all of the coal-grinding machinery, replacing the former building that was of wood construction, lately destroyed by fire. All bins in this building are of concrete.

The pottery contains a hydraulic retort press with a capacity of 250 retorts per day and pug mill of the same make as mill. The condenser building is separate from the pottery building proper and contains a Garrison-Whipple condenser machine, with the kilns adjacent to the building. All of the retort tempering kilns are situated between the distillation furnaces.

The entire plant is equipped with the Hunt system of trackage and cars, carts and mules being used for work only where track is not available. The ores smelted are Missouri sulphides and silicates, together with some high-grade Mexican carbonates.

Three Plants at Bartlesville

After the gas at Iola was exhausted for all practical purposes, the industry that had flourished there removed south into the vast gas fields of Oklahoma, the first plants being erected at Bartlesville, where are now the plants of the Bartlesville Zinc Co., two in number, and the plant of the National Zinc Co., a Beer-Sondheimer interest. The Bartlesville Zinc Co. has one plant containing 5184 retorts and the other 3456. These smelteries have Iola distillation furnaces, and Zellweger roasting furnaces. The pottery is equipped with a Mehler hydraulic retort press and the condensers are made by hand and also to some extent with the Vannata condenser machine. The ores mostly smelted are western with some Mexican carbonates and silicates. Gas is used for fuel in all departments.

The National Zinc Co. has Iola furnaces comprising 4256 retorts and Zellweger kilns. The pottery has an auger machine for making retorts; condensers are made by hand. This company has a very complete system of tempering the clay used in the manufacture of retorts and condensers by means of brick cells heated with steam which is a departure from the old way of letting the clay temper or "weather" in the open air. All power is electric, even to the cars used to transport materials in the yard, and is generated on the premises.

The three plants at Bartlesville obtain their supply of gas from the "Hogshooter" district, a wonderful field about 10 miles southeast of the town, which has produced more gas per acre than any other known territory. All own their own wells and have many thousand acres under lease in this district.

Dearing and Caney

Returning to Kansas we find at Dearing and Caney the two plants of the American Zinc, Lead & Smelting Co., the former having 3840 retorts and the latter 3648. The distillation furnaces are of the Iola construction; Zellweger kilns are used for roasting. The potteries are provided with a double hydraulic press, the invention of C. A. Wettengell, the mechanical engineer of this company, which is a great success, having two plungers instead of the usual one, thus being much faster than the Mehler machine. At Caney they have a Garrison-Whipple condenser mill in the condenser building. This company obtains almost all its ores (blende) from its mines at Carterville, Mo., unless the market justifies purchasing. It has a large gas field to draw from and is using the natural flow of the wells without the help of any pumps or compressors. Both plants are in full operation.

Altoona-Granby-Chanute

To the north of Dearing, about 18 miles, is the plant of the Altoona Zinc Co., an old Cockerill plant, but operated until the first of 1912 by the Beer-Sondheimer interest, now being operated by the bondholders that took over the Cockerill interests after the failure of the Cockerill Zinc Co. and organized as the Kansas Zinc Co. This plant smelts Mexican ores exclusively, having a bonded warehouse for that purpose, all ores being shipped in bond. Gas for fuel is supplied by the Portland Pipe Line Co. The pottery is equipped with an auger machine for the manufacture of retorts; condensers are made by hand. The roasting is done by Zellweger furnaces. The distillation furnaces are of the Iola style and comprise 3840 retorts.

The Granby Mining & Smelting Co. has a plant at Neodesha, Kan. of 3840 retorts, furnaces of Iola construction, Zellweger kilns for roasting. The pottery is equipped with a Garrison-Whipple condenser machine.

This company owns in fee and leases much valuable gas land and is constantly bringing in new wells. It also owns the largest amount of ore producing land of any one company or individual in the southwest Missouri zinc district. This company makes a specialty of high-grade spelter produced from silicate ore of high grade, free from lead. East of Neodesha, about 15 miles, at the town of Chanute, Kan. is the plant of the Chanute Zinc Co., consisting of 1280 retorts in furnaces on the style of the Edgar Zinc Co. Each furnace has 160 retorts, four rows high. The pottery is equipped with an auger machine for the manufacture of retorts; condensers are made by hand. The roasting furnaces are a modification of the Ropp, a form that was in considerable use before the Zellweger was introduced. This company owns its own gas, supplying other consumers in the vicinity, and smelts Missouri ore only.

Two Plants at Collinsville

At Collinsville, Okla., south of Bartlesville, there are two plants. The Tulsa Fuel & Manufacturing Co. has Iola furnaces comprising 3320 retorts, and Zellweger kilns. The pottery has an auger machine for manufacturing retorts. The condensers are made by hand and also by the Vannata machine. The Collinsville Zinc Co., as it is locally known, is a plant belonging to the same interests that own the Bartlesville Nos. 1 and 2 works and was constructed from one of the old Iola plants. It has 3200 retorts, Iola furnaces and Zellweger kilns. It is noteworthy for having in use the first Mehler hydraulic retort press imported to this country. This machine is in good shape even at this late date. The condenser building is equipped with a Garrison-Whipple condenser machine. All power is electrical, individual motors being used throughout the plant. The two plants at Collinsville get their gas from a field that has a large volume and a very high rock pressure. The ores smelted are mostly western; some Missouri ore is used, but not to any great extent.

Some General Remarks

All of the smelteries that I have described are in what is known as the "Mid-continent Oil and Gas Territory" and while much has been said and written regarding the diminishing gas supply of this territory I think that it will be many years before the supply is exhausted to such an extent that none will be available for smelting ore. It must be borne in mind that all of the smelteries are still using the natural flow of gas, conveying it through miles of pipe line, and they are not using pumps or compressors, except in one or two cases. Many wells that were drilled for oil have "come in" with gas and

the persons owning them are very anxious for a market. The large companies supplying natural gas for domestic purposes are gradually withdrawing from the important centers owing to the many difficulties that it seems impossible to overcome in the transmission of this gas. All of the large fields, although drawn on heavily at the present writing, will furnish gas for many years to come, I think, if it be consumed only at home. Contrary to the general opinion, it does not take an immense quantity of gas to operate a zinc smeltery; not nearly as much as to operate a brickyard or a cement works. At the present time all of the plants that I have mentioned are in operation to their fullest capacity and many of them expanding. Regarded from all angles, no region is more advantageous for zinc smelting than this one, which has the grandest and cheapest fuel that is known, coal for reduction material at the very doors of the several works, and ability to export spelter via Galveston to Europe more cheaply than it can be shipped to New York by rail. The towns are pleasant to live in, having all the advantages of churches, schools and social intercourse. Labor is efficient and the men work steadily.

The smelteries are all in charge of men that have been "born" in the business. The zinc industry is of such a character that it seems that a man must have been associated most intimately with it in order to be successful as an operator.

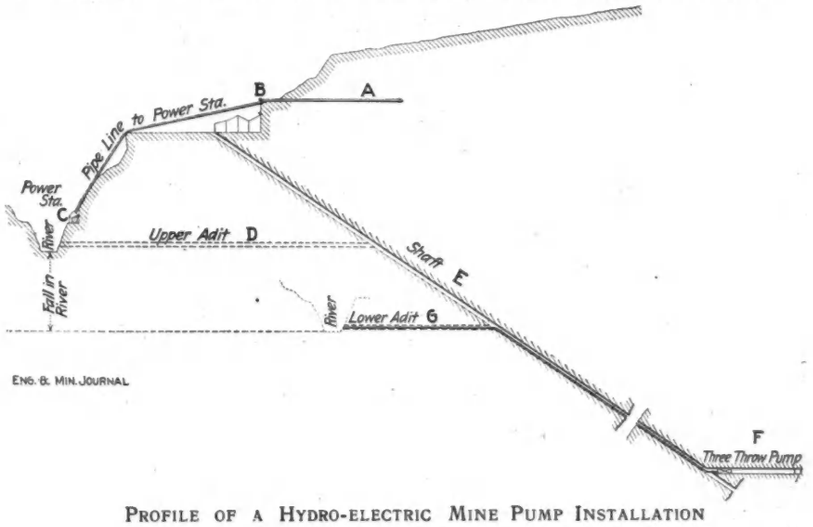
We hear of our wasteful methods as compared with European practice, but a trip through any of our works will disclose that we do not do so badly as supposed. Each has solved in his own way problems peculiar to his own case. While in all other metal smelting there is to a certain extent a universal practice or method, the zinc smelting industry is peculiarly an art and science of its own.

Pumping Plant at a Brazilian Gold Mine

A hydro-electric pumping plant has recently been installed by the Sandycroft Foundry Co., of Chester, England, at a Brazilian gold mine. The system is shown schematically in the accompanying illustration.

The collar of the incline *E*, is on the side of a hill, below which is a river. From the incline two adits, *D* and *G*, are driven to different points in the course of the stream.

Water is led to the power station at *C* from a small stream through a duct and pipe line, *A* and *B*, the tail water from the station being discharged into the river below. The power is brought into the shaft through the upper adit, *D*, and is thence conducted down the shaft, *E*, to the three-throw electric pump *F*. This pump draws the water from the level and pumps it to the lower adit *G*, through which it runs to the river.



PROFILE OF A HYDRO-ELECTRIC MINE PUMP INSTALLATION

The water delivered to the power station is under a head of 200 ft. and 282 cu.ft. per min. is discharged from the 16-in. pipe line. A double-vortex, inward-flow Gilkes turbine in the power house develops 80 b.hp. at 1000 r.p.m. and drives a three-phase generator, rated at 68 k.v.a., 500 v. and 50 cycles. An exciter giving 100 v. is also driven by belt from the turbine shaft. Each phase of the current is carried by a bare copper conductor hung in leather suspenders from porcelain insulators along the adit *D*, to a junction box from which point a 3-core insulated cable passes down the shaft to the pump.

The pump motor is a 50-b.hp. Sandycroft-Hunt "cascade"-type, having no slip-rings, rubbing contacts or brush gear. The motor drives a three-throw plunger pump mounted on the same bedplate, each plunger being 7 in. diameter and 12-in. stroke, running single acting at the rate of 53 s.p.m. The pump has a capacity of 250 gal. per min. against 450-ft. head, the efficiency being 75 to 80 per cent.

Ankylostomiasis in Cornwall

LONDON CORRESPONDENCE

Dr. E. A. Boycott, lecturer in pathology at Guy's Hospital, London, in giving evidence before the Royal Commission on Metalliferous Mines and Quarries, said that in 1902, every miner in Dolcoath suffered more or less from the disease. In 1903-04, the rate of infection was about the same, showing that the curative measures adopted were not as effective as anticipated. At this period there were very few men incapacitated.

In April, 1908, a special examination was made to discover how far the sanitary conditions introduced in 1904 had been successful. Eighty-nine persons were examined, mostly boys, and 76% were found infected, showing that there was still a danger from infection. In June, 1911, 62 miners were examined, and only 43, or 69%, gave positive results, showing a perceptible and beneficent decrease.

Further tests were made as to the time each affected miner worked, and the result may be tabulated as follows: Of 11 persons who worked less than one year, only four, or 36% were infected; in the case of 22 who had worked from one to three years, 19, or 86%, were infected; in the case of 17 examined, who had worked from four to six years, 13, or 76%, were infected; while in the case of 12, who had worked more than six years, 7, or 58%, were infected. It was hoped that the disease, after the precautionary measures which were adopted in 1904, would have shown a greater decrease; still, the results must not be regarded as disappointing.

At the Basset mines, 63 miners were examined, and 51% were infected; Botallack, 12%; South Crofty, 11; Trenwith, 8; Dolcoath, 69%. There was no evidence given to show that there had been an increase during the 10 years. The miners may carry the disease from one mine to another, as a miner may leave one mine and work in another without a medical examination.

Umber and sienna consist of silicates of iron and aluminum, containing varying proportions of manganic oxide. Zinc-lead is a white pigment (*Bull.* U. S. Geol. Survey) consisting apparently of a molecular combination of zinc oxide and lead sulphate, with small proportions of lead oxide, lead carbonate and zinc sulphate. It is prepared by sublimation from low-grade zinc-lead ore. The pigment is fine, amorphous and uniform in the size of its particles.

Effects of Mine Atmosphere on Miners

By W. Hanauer

Several years ago tests were carried out at the Institute of Hygiene in Breslau by Professor Reichenbach and Doctor Heymann to determine whether miners become acclimated to the unfavorable conditions in the mines. For this purpose measurements were taken of the body temperatures and the pulse of workers in the coal mines in the Saar district and upper Silesia, and of outside workers for comparison.

The air temperatures in the working places in the mines ranged from 57° to 75° F., the humidity in one case was found to be only 85%, but in all other cases above 90%. A great difference in the air current was found to exist between the galleries with column-supported and truss-supported roofs. In the former no measurable, and at the most only a noticeable movement of the air could be felt, although the air passages were large; in the latter an active ventilation was noticed. The miners' temperature was found to be 97.7° F. when they were resting above ground, and always over 98.6° F. in the mines.

Less Temperature Rise in Acclimated Miners

The high humidity was the determining influence, apart from which the temperature changes remained entirely without influence. The pulse rate varied considerably and gave no results of value. A continued high temperature was proved in all these mines where it was to be expected. An acclimatization to the mine conditions appears to obtain to this extent, that the body temperature does not increase so much as with unacclimated persons.

The effect of becoming accustomed to the results of continued high temperature is peculiar. Subjective sicknesses did not appear at all, and the capacity for work was not lowered; also objective illnesses could not be recognized. In spite of this it looks as if its continued influence finally has an unfavorable effect, for the total incapacity of the workers in the coal mines, where the humidity is greater than in other mines, begins at 45, nine years earlier than with other miners.

After Reichenbach and Heymann had shown by these tests that intense bodily activity in hot rooms favored the appearance of continued high temperatures, if the air at the same time was moist, and was not in motion, Doctors Liefermann and Klostermann of Halle made similar tests in the Burbach, Sollstadt, and Thiederhall salt mines, at the suggestion of the Halle mining commission. Detailed tests showed that the air in the workings was not particularly impure. The temperature varied between 70° and 84° F., and there was no measurable movement of the air. The humidity was low, varying from 40 to 50%. Measurements of the temperatures of 49 miners, between the ages of 20 and 40 showed that, in comparison with the conditions above ground, the average increase in temperature was 0.45° F. in the Burbach mine, and 0.72° F. in the Thiederhall. Although there was no movement of the air the increase in the body temperatures was small, apparently because of the low humidity. The dry hot air of the salt mines worked against the formation of a continued high humidity. No reasons were found for any unfavorable influence of these increases of temperature, or of the salt mine conditions at all, on the health of the miners.

Temperature in Deep Potash Mines

Recently tests were made, at the invitation of the Clausthal mining commission, in the deep potash mines in regard to the influence on the miners by Doctor Rosenthal of Göttingen. In the province of Hanover potash beds have been opened at a depth so great that temperatures have been reached not previously observed in Germany. The problem was to ascertain whether troubles were to be feared for the miners, and if so, how they could be provided against. Tests were made in four mines. In one, where the main level was 2985 ft. below the surface, temperatures from 84° to 86° F. were found. The humidity which was 80% above ground, ranged from 27 to 43%. High temperatures and great dryness of the air are characteristic of all the potash mines. At the working places further increases of 1.8° to 3.6° F. were found in the air temperatures, which Doctor Rosenthal thinks are due to the miners themselves, their lamps, and the splitting and cracking of the salt. A rapid movement of the air in the workings is favorable for the men, as it lowers the heat of their bodies by evaporation of the perspiration. In the main level, however, it feels cold, and may easily lead to health troubles. Measurements of the temperature, pulse, and respiration were made on the miners, Doctor Rosenthal, and his companions. In only single cases was the temperature as high as 100.4° F., and in general, extremely small differences were found from normal conditions. From the observations of the physicians of the miners' union no sicknesses arose through troubles of the heat regulations.

As the temperature of the workings is almost that of the mens' bodies, in some cases even more, the giving out of heat is equalized through radiation and conduction. On the other hand evaporation from the men's bodies is greatly increased by dry air, its movement, and the fact that it has free play on the unclothed upper part of their bodies. Free perspiration is helped by more than sufficient drinking. Alcoholic liquors cannot be carried into the mines, but weak coffee is furnished, partly free and partly at a low price, and is taken in large quantities. Doctor Rosenthal mentions that those who have been in the mines the longest drink the least.

The author of this article does not think it right that a temperature of 86° F. should be the only factor considered in fixing the working time in the mines at only six hours, the degree of humidity should also be taken into consideration. If potash beds at a greater depth than 3000 ft. come to be worked, which is by no means impossible, temperatures of 104° F. will probably be reached. In this case consideration should be given not only to a further shortening of the working time, but also to specially rapid movements of the air, and also cooling of the air through the installation of cooling machines at the bottom of the mine.

*Translated by G. B. Waterhouse from an article in Oest. Zeit. f. B. u. H.

California Oil Dividends

Including the preferred stock of Mexican Petroleum, Ltd., $825,842 was the amount paid by California oil companies as dividends during the month of March, says the San Francisco *Chronicle*. The dividend of $100,000 paid by the Amalgamated was an extra payment at the rate of $2 per share. Oil dividends of nearly a million in one month do not look as if the oil industry were in such bad condition after all. The following is the table:

Amalgamated	$2.00	$100,000
*Buick	0.04	127,254
Caribou	0.025	8,070
Central	0.015	15,400
Claremont	0.015	7,500
Columbia	0.01	9,992
Fullerton	0.05	30,000
Home	0.10	7,500
Homestake	0.01	1,000
*Mount Diablo	0.015	7,500
Monte Cristo	0.025	12,500
New Pennsylvania	0.005	2,500
Paraffine	0.01	3,000
Record	0.01	10,000
Rice Ranch	0.015	4,500
San Francisco-McKittrick	0.10	5,000
Sauer Dough	0.02	7,500
Section Twenty-five	0.25	10,000
Silver Tip	0.05	15,000
*State Consolidated	0.01	5,000
Traders	0.006	9,000
Union Oil	0.006	183,387
Union Provident	0.006	90,788
United Petroleum	0.006	48,451
Western Union	0.01	10,000
W. K.	0.03	15,000
Total California companies		$745,842
Mexican Pet., Ltd., pfd.	0.00½	80,000
Total		$825,842

*Unlisted

There are other closely held dividend-paying stocks, which do not make their disbursements public.

Mining and Metallurgical Patents

A Classified List of New Inventions

A copy of the specification of any of these patents issued by the United States Patent Office will be mailed by "The Engineering and Mining Journal" upon the receipt of 25 cents. British patents are supplied at 40 cents. In ordering specifications, correspondents are requested to give the number, name of inventor and date of issue.

COPPER

LEACHING—Process of Treating Copper Ores. Rudolf Gahl, Morenci, Ariz. (U. S. No. 1,021,768; Apr. 2, 1912.)

LEACHING—Process of Treating Ores. Rudolf Gahl, Morenci, Ariz. (U. S. No. 1,021,769; Apr. 2, 1912.)

PYRITIC SMELTING — Process of Smelting Sulphide Ores. August Haggenmiller, Tarica, Peru. (U. S. No. 1,021,096; Mar. 26, 1912.)

ROASTING—Improvements in or Relating to the Chloridizing Roasting of Ores. Helsingborgs Koppar Verks Aktiebolag, Helsingborg, Sweden. (Brit. No. 16,957 of 1911.)

GOLD AND SILVER

AMALGAMATING FLUME TABLE. Earl H. Tate, Los Angeles, Calif. (U. S. No. 1,021,277; Mar. 26, 1912.)

AMALGAMATION—Gold and Quicksilver Saving Apparatus. Louis Sachse, Los Angeles, Calif. (U. S. No. 1,022,110; Apr. 2, 1912.)

CYANIDES—Process of Producing Cyanides and Cyanamides. Carl Bosch and Alwin Mittasch, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Germany, a Corporation. (U. S. No. 1,022,351; Apr. 2, 1912.)

CYANIDING—Leaching Solution for Extracting Metals from Ores. Jose Baxeres de Alzugaray, New York, N. Y., assignor to International Metallurgical Co., New York, N. Y. (U. S. No. 1,018,-955; Feb. 27, 1912.)

CYANIDING—Apparatus for the Treatment of Ore. John Gross and Louis Cohen, Denver, Colo. (U. S. No. 1,021,-248; Mar. 26, 1912.)

DREDGING — Spud-Operating Mechanism for Dredgers. John A. Johnson, Black Diamond, Calif. (U. S. No. 1,021,-933; Apr. 2, 1912.)

PULP AGITATOR. Charles Claudius Hafer, Phoenix, Ariz. (U. S. No. 1,020,-694; Mar. 19, 1912.)

IRON AND STEEL

BLAST-FURNACE CHARGING APPARATUS. Julian Kennedy, Pittsburg, Penn. (U. S. No. 1,021,534; Mar. 26, 1912.)

FERROMETALS—Process of Smelting Ores and Apparatus Therefor. Richard Fleming, Westfield, N. J. (U. S. No. 1,020,546; Mar. 19, 1912.)

PURIFYING—A Process of Purifying Iron and Steel. B. L. B. dit Reyer, Paris, France. (Brit. No. 6301 of 1911.)

LEAD, ZINC AND OTHER METALS

BORON—Method of Making Boron and Boron Alloys. Ezechiel Weinstraub, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,019,569; Mar. 5, 1912.)

LEAD and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,514; Mar. 19, 1912.)

NICKEL and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,513; Mar. 19, 1912.)

TIN and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,515; Mar. 19, 1912.)

TITANIUM ALLOYS. A. J. Rossi, Niagara Falls, N. Y., assignor to Titanium Alloy Manufacturing Co., New York. (U. S. Nos. 1,019,526; 1,019,527, and 1,019,-530; Mar. 5, 1912—U. S. Nos. 1,020,516 and 1,020,517; Mar. 19, 1912—U. S. Nos. 1,022,-526; 1,022,595; 1,022,597; 1,022,598; 1,022,-599; 1,022,600; 1,022,799; Apr. 9, 1912.)

ZINC and Method of Purifying and Improving the Same. Auguste J. Rossi, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,020,512; Mar. 19, 1912.)

ZINC—Improvements in or Relating to Zinc Distillation. J. C. Moulden and H. W. Webster, Seaton Carew, Durham, Eng. (Brit. No. 5196 of 1911.)

MINING—GENERAL

BLASTING—Safety Fuse. Irvin E. Barricklow, Antioch, Calif. (U. S. No. 1,020,249; Mar. 12, 1912.)

BORE HOLES—Means for Straightening or Altering the Direction or Course of a Bore Hole. Frank George Seineke, Johannesburg, Transvaal. (U. S. No. 1,022,705; Apr. 9, 1912.)

CHUTE—Mining Apparatus. Elmo Finley Kellum, Don Luis, Ariz. (U. S. No. 1,020,649; Mar. 19, 1912.)

DRILL—Rock Drill. Charles H. Locher, Glasgow, Va. (U. S. No. 1,018,834; Feb. 27, 1912.)

DRILL FORGING AND SHARPENING MACHINE. Carl O. Borkman, Victor, Colo. (U. S. No. 1,022,925; Apr. 9, 1912.)

DRILLING—Drill-Hole Cleaning Attachment for Hammer Drills. Daniel S. Waugh, Denver, Colo., assignor to the Denver Rock Drill & Machinery Co., Denver, Colo. (U. S. No. 13,403; Apr. 9, 1912.)

DRILLS—Improvements Relating to Holders for Mining, Boring and Other Drills. R. Thomas and Owen Lewis, Clydach, near Swansea, Wales. (Brit. No. 2505 of 1911.)

DRILLS—Rotating and Feeding Mechanism for Drill Bars. Lester C. Hardsocg, Ottumwa, Iowa, assignor to Hardsocg Manufacturing Co., Ottumwa, Iowa. (U. S. No. 1,020,903; Mar. 19, 1912.)

FLUME—Metal Flume. Andrew J. Wiley, Boise, Idaho. (U. S. No. 1,019,-870 and 1,019,871; Mar. 12, 1912.)

GAS—Mine-Protection System for Collecting and Removing Gas. James McGavin, Chicago, Ill. (U. S. No. 1,021,-370; Mar. 26, 1912.)

HOISTING—Safety Apparatus for Supporting Mine Cages or the Like. Charles Dickie, Frederick Lambert and Richard Stables, Kimberley, South Africa. (U. S. No. 1,020,483; Mar. 19, 1912.)

LAMP—Miner's Lamp. Harry Becker, Baltimore, Md. (U. S. No. 1,019,748; Mar. 12, 1912.)

MINER'S CANDLESTICK. Antonio Viera, Ray, Ariz. (U. S. No. 1,020,332; Mar. 12, 1912.)

PROP for Mines. Otto Grünewald and Max Gorich, Ehrenfeld, near Cologne, Germany. (U. S. No. 1,021,249; Mar. 26, 1912.)

SHAFT LINING—Improvements in or Relating to the Construction of Shaft Lining. W. Breil, Essen-Ruhr, Germany. (Brit. No. 7100 of 1911.)

SIGNALING—Mine Signaling Device. John Rule, Jackson, Calif. (U. S. No. 1,023,040; Apr. 9, 1912.)

TUNNELING—Form for Tunnel Work. Edward G. Williams and Elmer H. Brown, Washington, D. C. (U. S. No. 1,017,029; Feb. 18, 1912.)

ORE DRESSING—GENERAL

CONCENTRATORS—Head Motion for Ore Concentrators. John F. Isbell, Salt Lake City, Utah, assignor to Gallagher Machinery Co., Salt Lake City, Utah. (U. S. No. 1,019,650; Mar. 5, 1912.)

CRUSHING and Separating Fine Materials. Thomas A. Edison, Llewellyn Park, West Orange, N. J. (U. S. No. 13,382, reissue; Mar. 12, 1912.)

CRUSHING—Improvements in Stone-Breaking, Ore-Crushing and Other Like Machines. W. H. Baxter, Leeds, Eng. (Brit. No. 28,566 of 1911.)

ELECTROSTATIC SEPARATION — Process of Electrostatic Separation. Henry M. Sutton, Walter L. Steele and Edwin G. Steele, Dallas, Tex. (U. S. No. 1,020,063; Mar. 12, 1912.)

FLOTATION PROCESS—Art of Concentration of Mineral Substances. James M. Hyde, Basin, Mont. (U. S. No. 1,022,-085; Apr. 2, 1912.)

PULVERIZING MILL. Walter A. Galland, Denver, Colo., assignor to John H. Elspass, Denver, Colo. (U. S. No. 1,021,-981; Apr. 2, 1912.)

SLUDGE TABLE. O. W. Dunham, Joplin, Mo., assignor, by mesne assignments, to Braeckel Concentrator Co., Joplin, Mo. (U. S. No. 1,023,009; Apr. 9, 1912.)

METALLURGY—GENERAL

CHARGING — Mechanical Charging Mechanism for Smelting Furnaces and the Like. Irving L. Briggs, Newport, Del. (U. S. No. 1,022,654; Apr. 9, 1912.)

ELECTRIC FURNACE. Albert E. Greene, Pueblo, Colo. (U. S. No. 1,021,-187; Mar. 26, 1912.)

ELECTROLYSIS of Metallic Solutions. Fernand Lacroix, Paris, France. (U. S. No. 1,019,969; Mar. 12, 1912.)

FIREBRICK—Process of Making Firebrick. Charles H. Jaxtheimer, New Wilmington, Penn. (U. S. No. 1,018,665; Feb. 27, 1912.)

FURNACE LINING—Fire-Brick Wall or Lining for Blast and Other Furnaces. Allan N. H. Strale, Chicago, Ill., assignor of one-half to Emanuel Block, Chicago, Ill. (U. S. No. 1,021,851; Apr. 2, 1912.)

LADLE CAR. William W. McKelvey, Youngstown, Ohio, assignor to William B. Pollock Co., Youngstown, Ohio. (U. S. No. 1,021,543; Mar. 26, 1912.)

REDUCTION — Improvement in and Relating to the Reduction of Ore. Sven Emil Sieruin, Hoganas, Sweden. (Brit. No. 1134 of 1911.)

REDUCTION — Improvement in the Method of and Apparatus for Reducing Ores of Volatile Metals. H. H. Hughes, Springfield, Mo. (Brit. No. 570 of 1911.)

ROASTING—An Improvement in Processes for Roasting Sulphide Ores. C. W. Renwick, Isabella, Tenn. (Brit. No. 1267 of 1911.)

ROASTING—Charging Apparatus for Mechanical Roasting Furnaces and the Like. Metallbank- und Metallurgische Gesellschaft Actiengesellschaft, Frankfurt-on-Main, Germany. (Brit. No. 19,-314 of 1911.)

ROASTING — Process for Roasting Ores. Charles Gabrielli, Paris, France. (U. S. No. 1,018,609; Feb. 27, 1912.)

ROASTING AND SINTERING—Apparatus for Roasting and Sintering Ores. Arthur S. Dwight, New York, N. Y., assignor, by mesne assignments, to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,021,509; Mar. 26, 1912.)

ROASTING FURNACE. T. D. Merton, Grove Mill, Watford, England, assignor of one-half to Harry MacKenzie Ridge, London, England. (U. S. No. 1,022,961; Apr. 9, 1912.)

ROASTING KILN—Recuperative Roasting Kiln. John Zellweger, St. Louis, Mo. (U. S. No. 1,017,839; Feb. 20, 1912.)

SCRAP METAL—Process of Melting Scrap Metal. Albert E. Greene, Chicago, Ill. (U. S. No. 1,018,418; Feb. 27, 1912.)

SINTERING—Metalliferous Ore Product. Arthur S. Dwight and Richard L. Lloyd, New York, N. Y., assignors, by mesne assignments, to Dwight & Lloyd Metallurgical Co., Jersey City, N. J. (U. S. No. 1,020,345, Mar. 12, 1912.)

SPOUT—Duplex Spout for Furnaces George K. Hooper, Madison, N. J. (U. S No. 1,016,013; Jan. 30, 1912.)

PERSONALS

Mining and metallurgical engineers are invited to keep The Engineering and Mining Journal informed of their movements and appointments.

Henry H. Armstead, of Guanajuato, Mexico, is in New York.

H. Kenyon Burch is at Globe, Ariz., where he is engaged on professional work.

C. Clerc, of Paris, France, is at present in Arizona, examining mines near Wickenburg.

J. M. Fitzgerald has been chosen president of the Davis Coal & Coke Co., of West Virginia.

F. M. Simonds, of Simonds & Burns, New York, is at present in Cuba on professional business.

W. R. Ingalls delivered the class-day address at Houghton, Mich., on Apr. 18, for the Michigan College of Mines.

R. B. Lamb has returned to Toronto from a visit to the Swastika and Porcupine properties, in which he is interested.

R. J. Wysor has been made chief chemist of the Bethlehem Steel Co., succeeding Robert C. Kresge, who recently resigned.

Hugh Poynter Bell, an English chemical engineer, is in Canada, making investigations in connection with the peat-fuel and natural-gas industries.

H. V. Winchell was in New York this week, returning to Minneapolis. He expects to be in New York again about the middle of May, and to sail for Europe.

Ricketts & Banks, mining, metallurgical and chemical engineers, announce that on and after May 1, their offices and laboratories will be in the Eighty Maiden Lane Building, New York.

L. D. Huntoon, B. Stoughton and A. H. Elliott have associated themselves for the general practice of mining, metallurgical and chemical engineering, with offices at 165 Broadway, New York.

Sir Robert A. Hadfield, Sheffield, England, has been elected a foreign member of the Royal Swedish Academy of Science, Stockholm, as "a token of its appreciation of his excellent work in metallurgy."

E. F. Lake has been placed in charge of the laboratory of the Perfection Spring Co., Cleveland, Ohio. Mr. Lake has recently been conducting a consulting metallurgical business. He was formerly steel editor of the *American Machinist.*

J. T. Haviland, of the U. S. Geological Survey, is making a complete survey of the middle fork of Feather River, starting at Bidwell Bar, Butte County, Calif., and going northerly toward the source of the stream, to determine the potential power possibilities of the streams.

J. B. Tyrrell, the well known geologist and mining engineer, is to lead the Ontario government expedition into the North to locate the five-mile strip which the province is to receive from the Dominion. Mr. Tyrrell's personal knowledge of the unopened lands of the Hudson Bay district will make his services of great value to the province. One or two surveyors and half a dozen Indians will probably compose the party. Although the route has not been settled, the party will probably proceed first to Winnipeg about the end of May, and thence by Lake Winnipeg to Port Nelson, much of the journey by canoe. At the mouth of the Nelson River, some time will be spent in locating the 10-mile strip, which Ontario will have as a terminus for the Temiskaming & Northern Ontario Ry., should it be decided to extend the line there. The party will then head for the south, and a larger part of the five months will be taken up in exploring the 50-mile stretch along Hudson Bay, anywhere in which the province has a right to choose its five-mile strip.

OBITUARY

H. W. Mussen, mining engineer, formerly of Toronto, Ont., died at Kiev, Russia, on Apr. 18, aged 38 years, as the result of an accident. He was a graduate of McGill University, Montreal, and had been following his profession in Russia for several years.

Horace J. Stevens died suddenly at Houghton, Mich., April 22, aged 48 years. He had been a resident of the Michigan mining country for many years. He was for some time editor of a daily paper at Ishpeming. About 10 years ago he begun the compilation of "Stevens" Copper Handbook" and has since continued its yearly publication, by which he became well known.

Ebenezer Rowland, one of the pioneer mining men of the Marquette Range, died recently at Boulder, Colo., where he had resided for some years. He was 81 years of age. He was born in England, but came to this country with his parents when three years of age. He was employed at a number of mines in the Lake Superior district and had charge of the Iron Cliffs furnace and sawmill and later was superintendent of the Barnum mine.

Thomas Edwards, well known as a mill manager and metallurgist and the designer of the Edwards roasting furnace, died at Melbourne, Victoria, early in February, aged 74 years. He was born in Cornwall and went to Australia when a boy. He was at different times connected with the Clunes United, the Mount Morgan and other important mines, and with the large treatment plant at Sebastopol, in the Ballarat district, which he founded. He was a large owner of mining property in Victoria.

Dr. Paul G. Freer died at Manila, P. I., Apr. 17, aged 50 years. He was born in Chicago, educated in that city and at the University of Munich. He was instructor at Tufts College a short time and professor of chemistry at the University of Michigan for 14 years. In 1903 he was made director of the government laboratories, in Washington, and in 1905 he went to Manila as director of the Philippine Bureau of Science. He was the author of several books on chemistry and of a number of valuable reports on the Philippines. He was a member of the American Chemical Society and of several foreign societies.

Samuel B. Ferguson died at Coulterville, Mariposa County, Calif., Apr. 6. He was born in Kentucky in 1832. He crossed the plains from Missouri to California in 1852, and had been actively engaged in mining operations in California, Nevada and Mexico until within recent years. Mr. Ferguson was instrumental in settling the miners' strike at Treasure City, Nev., in 1867. He controlled extensive operations in Bodie during the prosperous days of that camp and early in the history of the Comstock was employed as manager of the interests of James Fair, having under his supervision the Gould & Curry, Best & Belcher and Con-Virginia. He was for 35 years manager of the Cook mine in the Coulterville district in California.

Societies and Technical Schools

American Institute of Mining Engineers—The New York Section will hold a meeting at the Engineering Societies Building, New York, May 3, at which Prof. L. C. Graton and Joseph Murdock, both of Harvard University, will present views, illustrating "The Mineral Relations in Copper Sulphide Ores as Revealed by the Microscope." The deductions from this method of geological research will be exhibited graphically, and will be discussed orally by Profs. J. F. Kemp and William Campbell, of Columbia University.

Lehigh University—The class in Economic Geology, accompanied by Professors Miller and Eckfeldt, of the departments of Geology and Mining Engineering, have recently made week-end trips to several important mining districts of Pennsylvania and New Jersey. On Mar. 22 and 23, the concentrating plant of the Pennsylvania Steel Co., at Lebannon, and the magnetite mines of the Cornwall Ore Banks Co., at Cornwall, were visited; on Mar. 30, the class inspected the mines and furnaces of the Empire Steel & Iron Co., at Oxford Furnace, N. J.; and on Apr. 12 and 13, the class visited the mines and mill of the New Jersey Zinc Co., at Franklin Furnace.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Apr. 17—Plans have been arranged for a visit to the Penn Mining Co.'s smeltery, at Campo Seco, in Calaveras County, by representatives of the Department of Justice, the U. S. Bureau of Mines and some of the important smeltery interests of the country. The purpose will be to investigate the thiogen process, invented by Doctor Young, of Stanford University, and now in the experimental stage at the Penn smeltery. The Department of Justice will be represented by Ligon Johnson and Dr. L. D. Ricketts; the Bureau of Mines by Doctor Holmes and F. E. Cottrell. It is expected that the Amalgamated Copper Co., and the Balaklaia will also be represented.

A company, recently formed, has taken over the patent on Doctor Young's process, and when it has been successfully and thoroughly demonstrated at the Penn smeltery, the process may be introduced at other smelteries, whose operations have been interrupted by farmers. In California, it is fairly well known that the farmers have not been as badly hurt as their complaints have often indicated, but these complaints have been heard by the courts and a necessity for preventing a recurrence of the damage has been demanded by the bench. From the recent tests made at the Penn mine, there is some reason to believe that the thiogen process will be successful. Also, it has been fairly demonstrated at the Balaklala that the Cottrell system successfully accomplishes the neutralizing of the smoke, but the results did not reach a point to correspond with the demands of the court, so the smeltery was closed and the laboratory experiments continued. It is believed in California that both the Cottrell and Young processes will eventually prove as successful for eliminating the trouble as the baghouse in the Mammoth smeltery, at Kennett, Shasta County.

Butte

Apr. 17—Work has been started on the new branch line of the Chicago, Milwaukee & Puget Sound R.R. from Three Forks into the Radersburg mining district, and it is believed that trains will be running over it by autumn. This will mean much to Radersburg, as a number of properties there are shipping ore by wagon at considerable cost, and others are being developed to the shipping stage. It is also the intention to extend the line on into Helena.

A simple contrivance for doing away with the dust from hammer drills has been invented by Thomas Mitchell, foreman of the Leonard mine of the Anaconda company. Although used thus far only in test cases, it has proved satisfactory and it is likely that it will be installed in all the mines here, as the dust problem has long been a difficult one to contend with. Notwithstanding that many different devices for its elimination have been tried out, there has always been some factor causing their discontinuance, due to loss of time or an undue amount of care needed in their use. If Mr. Mitchell's invention is found to be suitable on a large scale, as it has been in the tests, it will probably be a great boon to the miners, as miners' consumption, caused by inhaling the pulverized rock from the machine drills, is one of the chief illnesses contracted by the men after they have spent a few years in the mines. The device, which is simple and can be manufactured at small cost, consists of four iron fingers attached to an iron ring, the fingers acting as a spring and arranged to fit into and to take a secure hold on the mouth of the drill hole. A canvas bag is attached to the ring and another short cylinder of canvas fits over the drill. The dust flows from the hole into the canvas receptacle instead of into the air, as formerly.

Denver

Apr. 18—The crude bitumen known as gilsonite, so named after Samuel Gilson, who discovered it, occurs in Uinta County, Utah, in the territory tributary to the survey line of the Moffat Road. It is found in vertical fissures in the sandstones, and these veins vary in width from 2 to 17 ft.; the late G. H. Eldridge, of the U. S. Geological Survey, gave the probable available tonnage as 30,000,000 tons, this estimate being made from the exposures on two sides, the surface outcrops and a "break off" in the country, or steep cliff, which showed the deposits to exist for about 200 ft. in depth. This hydrocarbon field has been practically controlled for years by the Barber Asphalt Paving Co., that built the Uintah Ry., from Mack, on the Rio Grande Western R.R., to Dragon, at the southernmost part of the deposits. One of the leading independent companies was the American Asphaltum Association, of St. Louis, of which Adolphus Busch is the chief owner. With the so called asphalt trust owning the railway and practically dominating the market, the independent companies obviously operated at a disadvantage, and now comes the report that the Barber Asphalt Paving Co. is to gain control of the St. Louis company, a $3,000,000 corporation being launched in Utah for that purpose. The 7% grades on the Uintah Ry. are to be reduced this year by a series of tunnels, and an extension of the line is projected to the veins a few miles further north, owned by the St. Louis company.

Salt Lake City

Apr. 18—Park City shipments for March amounted to 9625 tons, the principal shippers being the Silver King Coalition, the Daly West and the Daly-Judge.

According to the annual advance statement of the lead production for 1911, just issued by the U. S. Geological Survey, Utah ranks third in the list of lead-producing states, with an output of 55,198 tons.

The ninth remodeled section of the Arthur mill of the Utah Copper Co. has been put in operation, and the combined capacity of the two mills is 18,000 tons per day. The overburden is being removed as rapidly as possible, and by autumn it is expected that the waste will be so reduced as to bring about a further reduction in costs. It is reported to be the intention to accumulate as large a working capital as will be necessary for stripping operations and for the maintenance and improvement of the plant.

The U. S. Assay Office here, during March handled 6890 oz. of gold, worth $128,191, and 3446½ oz. silver, worth $1792, the total being $129,983, and showing an increase of about $29,000 over the month preceding.

There is a movement on foot among Commercial Club members looking to the establishment of a bureau of mines as a part of the club organization. Funds for the maintenance of the bureau are to be obtained by subscription.

Construction has begun on the 35-mile wagon road between Green River station, on the Denver & Rio Grande R.R. and the San Rafael oil fields in Grand County, where increased activity is looked for during the spring and summer. The vanadium and uranium deposits are being developed.

Globe

Apr. 19—Norman C. Carmichael, general manager of the Arizona Copper Co., at Clifton, recently visited this district. He stated that 200 men are working on the grading for the new smeltery, at Clifton, and that the erection of the steel work should begin some time in July. He was further quoted as saying that from an economic standpoint the future of the Arizona Copper Co. looks bright, but that if the Kinney bill, now under consideration by the state legislature, at Phœnix, should be passed, it would mean a shutdown of the mines and the complete paralysis of the Clifton-Morenci district. The bill, as introduced, provides that it shall be unlawful to employ in mines, mills, smelteries, railroads, etc., "any person who cannot speak and understand the English language," and charges its enforcement to the state mine inspector and his deputies. The workmen of the Clifton-Morenci district are mostly Mexicans, and Mr. Carmichael says that it is impossisble to get white men to work and live in the climate and conditions obtaining in that district.

Deadwood

Apr. 18—Numerous signs indicate a season of prosperity for the Keystone-Hill City district, in Pennington County. D. Canfield and associates have spent the winter at the Golden Summit property, where they have opened a small shoot of rich ore, and when water is available they will start milling. The Colorado men, who have purchased the Forest City group, are planning extensive development to start soon. It is officially stated that shaft work will be resumed soon at the Dakota-Calumet copper property. Work is going forward at the Columbia mine, at Keystone, from which considerable smelting ore was shipped last year. A settlement of the litigation which has involved the J. R. property for several years seems to be in sight, and, if made, will result in an early resumption of work. The last mill run showed an encouraging grade of ore. In addition to these properties there are a number of others in early stages of development.

Cobalt

Apr. 19—The question of a commission of $50,000 for the sale of the Silver Cliff mine, in Cobalt, was tried recently in the assize court in Toronto, judgment being reserved. A syndicate, consisting of A. R. Peacock and associates, agreed to purchase the mine for $550,000 from the owners, the sale being negotiated by Dr. A. F. Crane and associates, who are the defendants in the present suit. It is claimed that the defendants induced the owners to make the price of the mine $550,000, returning $50,000 as commission for the sale. The purchasers, learning this condition, compelled the original owners to pay the $50,000 into court, instead of paying it to the defendants, and they are now suing to regain posession of this amount. They claim that the purchase price was represented as $550,000, whereas the $50,000 had really been added to enable the defendants to obtain a commission without their knowledge. The Silver Cliff mine has had an unfortunate history, having always been operated at a loss. It is understood that the property may be reopened soon.

Porcupine

Apr. 19—The Ontario government is preparing to send an exploring party to the new northern territory, recently added to the province. The expedition will be in charge of J. B. Tyrrell, of Toronto, and is expected to start about the latter part of May and to be absent about five months. In addition to exploring the resources of the territory the party will locate the 10-mile strip along the water front at the mouth of the Nelson River, which will form the terminus of the Temiskaming & Northern Ontario Ry.; it will also lay out the five-mile belt of land which has been granted by the Dominion to give the province access to Hudson Bay.

It is stated that a discovery of nickel ore has been made in the vicinity of Fredrickhouse River. As yet but little has been learned of the property, but it is to be tested by means of a diamond drill. The formation is the same as that in which the nickel ore occurs near Kelso. A shipment is to be made soon from the latter mine.

Mexico City

Apr. 15—The Americans in Mexico generally accepted the proclamation of warning issued by President Taft, in February, as an official intimation that intervention was soon to come and they proceeded to prepare accordingly; in the mining camps, particularly, many of the Americans acted at once on the specific suggestion that in case they were compelled to leave the country they could place their property in the hands of the American consular representatives. But the consuls had no instructions or directions in the matter and they generally declined to accept any special responsibility in the matter, much to the disappointment of the Americans who were greatly alarmed, and with reason, as to the safety of their property in the large districts more or less controlled by the rebels. There will certainly be a large list of claims for property losses made by Americans and American mining companies, and it is not known how vigorously the American government will interest itself in their adjustment.

Officials of one of the large steamship lines, running between New York and Mexican ports, recently stated that for some weeks past bookings from Mexico to New York, for Americans, had been unusually heavy, but that recently they have fallen off to nearly normal. This would indicate that Mexico is becoming pretty well depleted of its Americans.

A prominent member of the Chamber of Deputies is said to have stated recently, that undoubtedly that body will promptly approve Madero's request for a treasury loan of $10,000,000 gold, to enable the government to increase the army to 60,000. The government's war bills have been referred to the committees on War and Treasury and will be reported favorably within a few days, possibly with minor amendments.

London

Apr. 15—The Rand-mines scandal has been a drawback to the whole market in mining shares. It is doubtful if a serious recovery will take place soon, though the South African houses are doing their best to attract the public. The sad experience of the rubber and oil boom, combined with the strong attacks on the policy of the South African houses, at the recent disclosures of the faults made by the management of the East Rand Proprietary and further at the transactions of the Rhodesian trust companies, have strongly shaken the belief of the public that some profit may be left for the outsiders.

The last year showed in the mining market only few events which could be considered as proof of sound financial policy in mining matters. For years a boom in Rhodesians has been predicted, but it does not come off. The great expectations of the Katanga copper field have so far been a complete failure; years must elapse before cheap production can lead to a good return on the large sums invested in the companies of that district.

Russian mining securities have had a boom here, which was soon followed by a complete collapse. The hopes in that country were renewed last year, when John Hays Hammond was invited by the Russian minister and stayed some time in St. Petersburg; no results of his visit have become known. The feature in Russian mines of most interest is Lena Goldfields, which developed into a paying enterprise. The Orsk Goldfields may become another good Russian gold producer after the new American dredge commences steady work this spring. No other Anglo-Russian gold-mining enterprise has been a success, though much money has been provided to find good properties in the Urals and Siberia. A small concern, Russian Goldfields, Ltd., was brought out in March, in England, to dredge certain properties in the Urals. The prospectus spoke of a length of 20 miles of river rights, with an average width of 25 yd., and an approximate depth of gravel of 7½ ft.; the tests are said to have shown results averaging 85c. per cubic yard.

The Mining News

The Current History of Mining

Alaska

Alaska-Ebner—This company, formerly the California-Nevada Copper Co., has gone into a receivership because of default of bond coupons. A plan of agreemeent has been drawn up between Mortimer N. Buckner, Herman W. Hoops and Lucius G. Fisher, acting as a committee, and such holders of the first mortgage, 7% bonds as wish to become parties to the agreement. The company owns mines in California and near the Alaska-Treadwell in Alaska.

Fairbanks District

H. J. Elmer passed through Fairbanks recently with 10 "double-enders" from Cordova, laden with repair parts for the big dredge he proposes to operate in the Circle district, on the Yukon. An early run is expected.

It is doubtful if Alaska has ever seen such a mild winter as has been experienced this year. The willows have been in bloom for three weeks. The break-up is looked for by May 1 instead of May 25. Placer operators are beginning preparations for early sluicing.

Garden Island—This mill recently finished the run on the ore taken from the Perault vein at the head of Pearl Creek and $40 per ton in free gold is the reported result. The vein is from 6 in. to 3 ft. wide.

Alaskan Exploration Co.—This company has been reorganized in London by G. G. Lemon and $500,000 have been paid into the treasury. Extra parts for the Lemon dredge are now on the way over the ice. In addition to extensive holdings on Fairbands Creek, the dredge company purchased the greater part of Twin and Pedro creeks last summer.

Arizona

Cochise County

Calumet & Arizona—The company recently purchased the old tailings dump of the Commonwealth mine, from J. N. Kinney, for $15,000. The tailings are used for converter linings.

Gila County

Miami—One of the electric locomotives on the 420-ft. main haulage level, escaped control recently and ran into the cage compartment of the main shaft, falling 300 ft. to the bottom. Aside from the loss of the locomotive, the damage was slight. F. L. Ransome, of the U. S. Geological Survey, has been making an inspection of the underground workings.

Inspiration Consolidated—The diverting flume at the dam across Pinal Creek gave way recently and allowed the excavation and forms to fill with débris which is now being cleaned out. The test mill is running and the sinking of No. 2 shaft at the Live Oak mine will be resumed soon, the installation of the surface plant being nearly completed.

Southwestern Miami—Churn-drill hole No. 2 has been discontinued at a depth of 1240 ft. in the chalcocite zone. Commercial ore was disclosed in this hole but how much is not made public. Hole No. 3 is 710 ft. deep and in the chalcocite zone. Holes Nos. 4, 5 and 6 are 235, 200 and 75 ft. deep respectively and have not yet passed through the conglomerate. No. 7 will be started soon.

South Live Oak—The arrival of machinery is expected within 10 days. The camp consists of an office building, boarding house, bunkhouse and four dwellings. The first hole will be on the western extension of the Augustus claim, in the granite-porphyry.

Barney—Churn-drill hole No. 2 is 560 ft. deep in schist. Progress is slow, the ground being soft and clayey, caving considerably and causing the drill to stick; it is possible to drill only a few feet without driving the casing. Hole No. 3 is 200 ft. deep and in conglomerate.

Arizona Copper Co.—The company is increasing the capacity of the power-plant equipment for its mines at Clifton, Ariz., and has purchased new electrical machinery, including three 2500-kv.-a., turbo-generators, and nine 417-kv.-a. transformers. The apparatus will be installed by the General Electric Company.

Pinal County

Ray Consolidated—The annual report covering the 18 months ended Dec. 1, 1911, shows a net profit from operations of $147,545. Copper amounting to 14,935,447 lb. was sold at an average of 13.8c. per lb.; the average cost was 10.75c. At the end of the year the reserves totaled 77,314,470 tons of 2.17% ore. Among the expenses were $556,397 for mining, $405,166 for milling and $564,019 for freight treatment and refining.

Santa Cruz County

Augusta—This mine is being unwatered by intending purchasers. It has a good record of production, but has been closed for two years. The ore is a ferruginous copper ore.

Eureka—This mine will be reopened by B. F. Lindsley, manager of the Mansfield Mining Co. It is a part of the Prof. Blake group, at Salero Hill. Some ore, running several thousand ounces of silver per ton, has been shipped from this mine. There is supposed to be some of this ore still left, as well as a large amount of concentrating ore.

Viceroy—A new strike of good copper ore has been made in this mine, owned by Mr. Bach; this mine is the easterly extension of the Blaud.

Ivanhoe—James Johnson, superintendent, has closed for his company, negotiations with eastern men for this mine. The price is $225,000, but the terms have not yet been made public.

Pulaski—The owners of this mine, in Josephine Cañon, have made a discovery of concentrating ore, carrying copper, lead and silver. The ore is 4 ft. thick and is getting better with depth.

Black Hill—Ore is being taken out for shipment to the new Pioneer smeltery, at Tucson. This ore samples 7½% copper.

California

Amador County

South Jackson—An electric motor will be installed to operate the new hoist under construction. The results of prospecting are said to warrant extensive development.

Keystone—The new compressor has been installed and will be used for the air drills. Sinking will be commenced in the old shaft which has been reopened and unwatered to the 1200-ft. level. This is the first time the bottom of the shaft has been reached in 20 years.

Lincoln Consolidated—The water has been drained from the 1915-ft. level, which is the lowest in the Lincoln mine, and the south level will be extended through the Mahoney into the Wildman.

Original Amador—R. H. McGowan has withdrawn his suit against this company. The dismissal vindicates the officials of the company. The mine is being developed under the supervision of W. F. Deaner.

Calaveras County

Tulloch—High-grade ore has been disclosed at the 200-ft. level on the hanging wall of a vein about 40 ft. wide. A streak of this ore carries free gold and there are good indications of ore running above the average low grade ores of the district. The

mine has been bonded to Judge Curtis, of Angels, who will proceed with the development. The property is near the Chapperal Hill mine, about 100 miles north of Melones. It was located about 20 years ago and was a large producer from pockets.

Lightner—It is reported that the old Lightner company and the Angels mines have settled their legal difficulties out of court. These differences bear no relation to the present owners and operators of the Lightner. The recent shutdown of the mill resulted from advancing the development beyond the talc.

North Star—The Dolling Co. has shut down the mill temporarily and developing is proceeding below the 400-ft. level. A quantity of good milling ore was procured but after getting into the talc intrusion was found not up to standard grade.

EL DORADO COUNTY

Crane Gulch—This mine, near Placerville, has been sold to H. G. Jerrett, who will begin development soon.

Cora Dora—This mine, near Grizzly Flat, is being operated by Plumas County men. It has been idle for some time.

INYO COUNTY

Skidoo—A suit is on trial at Los Angeles, in the U. S. court, in which William B. Gray, of Nevada, claims ownership of 10 fractional claims which have been operated as a part of the Skidoo mine. The Skidoo is one of the prosperous mines of Inyo County and the claims contested in this suit are said to be a valuable part of the holdings.

KERN COUNTY

Derby—The Standard drilled into a gas stratum at 488 ft. depth on this lease two miles east of Taft. The escaping gas cut the cable off, dropping the tools into the hole. Measurement showed the well to be making 65,000,000 ft. of gas per day. Two days following, the flow had been reduced to 41,000,000 ft. The existence of gas at this depth had not been known previously. This property lies at the south flank of the Buena Vista hills where a gas belt was encountered at 1600 ft. depth.

MARIPOSA COUNTY

Enterprise—A strike of good milling ore is reported from this mine near Hornitos.

PLUMAS COUNTY

Engle—An orebody 12 ft. wide was encountered while crosscutting to the hanging wall. The ore showed copper, gold and silver. The mine is in the Greenville district, near Taylorsville.

Rio Vista—This company is hauling in a large supply of material to the mine at Nelson Point. The old Franklin shaft will be unwatered to the gravel channel. E. P. Vandercook, of Oakland, is one of the owners.

SAN BERNARDINO

Another effort is being made to mine placer gold in Holcomb Valley. In the earlier days, gold was taken from this valley, but lack of water has prevented operations for several years. A preliminary survey was recently made for a pipe line. Harold Peck, of Los Angeles, conducted the survey for the water company, composed of residents of Long Beach and Oakland.

TRINITY COUNTY

Globe—A stamp mill is completed for this mine, at Dedric. The Craig Mining Co., composed of Chicago and Canadian men, is the owner. James Hooper is superintendent.

TUOLUMNE COUNTY

Tarantula—The development work in this mine has reached sufficient depth to warrant drifting, and it is expected that the stamp mill will soon be in operation.

Mammoth—The Old Republican mine, reopened by this company, is now in operation, and the 20-stamp mill is in commission.

Colorado

BOULDER COUNTY

Boulder Tungsten Production Co.—This company has been organized with J. G. Clark, of Boulder, as president, and it is stated that H. L. Barter & Co., of Chicago, have underwritten 700,000 shares of treasury stock. It is further stated that Mr. Clark is making preparations for mine machinery and a 50-ton mill.

CRIPPLE CREEK DISTRICT

El Paso—The main shaft has been connected by a raise from the deep drainage tunnel, making the total depth of the shaft 1350 ft. It took 78 continuous days and nights to make the 350-ft. raise.

Golden Cycle—The 15th and 16th levels of the shaft, drained recently, are being cleaned out, and it is expected that shipping will begin soon. The shaft is 1650 ft. deep. The output of the mine is about eight cars per day of good-grade gold ore.

South Burns—Lessees operating this and the main Burns shafts, have paid, it is reported, $100 per day in royalties to the Acacia Gold Mining Co. The gross production is given at $25,000 for the last six months.

Progressive—This company, leasing the Chicken Hawk, Katinka, August Flower and Hobo claims of the Katinka company, is sinking the shaft to the 1050-ft. level, where laterals will be driven.

Happy Day—A new shaft is being sunk by lessees on this claim of the Alamo company, on Gold Hill.

Camilla—J. Morrison & Co., leasing the Camilla, on Guyot Hill, have installed heavy machinery and are driving east and west from the 1000-ft. level, to intersect the Doctor-Jack Pot and Work veins.

Jo Dandy—It is reported that in six months the dump of this mine, treated at the Kavanagh mill, has paid the lessees $3000, and enough additional to pay for the mill.

LAKE COUNTY—LEADVILLE

George Argall, manager of the Iron-Silver Mining Co., is secretary of an association that purposes pumping the water from the lower levels of the Leadville mines. Power is to be supplied by the Central Colorado Power Company.

Across-the-Ocean—Thomas Gilroy, superintendent, is working eight men and has 50 tons of ore in the bins ready to ship when the roads will permit hauling. The principal metal in the ore is gold.

Henrietta—The shaft on Carbonate Hill has been repaired and put in good working order and the usual tonnage of zinc ore is being hoisted.

Long & Derry—Work has been resumed at this old producer, and a new shaft is down 70 ft., with ore showing in the drift. Work is to be resumed in the old shaft, 300 ft. deep.

Chippewa—Two cars of ore are at the smeltery awaiting settlement. The ore is said to run about 3 oz. gold per ton with some silver and copper. It is operated by Green Brothers, lessees.

Adelaide—This old mine has been connected with the Yak tunnel by a lateral driven 2000 ft. from the tunnel level, and a raise to connect with the old shaft, 510 ft. below surface. Andrew Dyatt, manager, expects to produce 50 tons per day.

Ponsardin—The surface plant has been installed and the shaft is being repaired; when this is completed, shipments will commence.

OURAY COUNTY

Bachelor & Wedge—Lessees Kelleher and Lucas are reported to have shipped four cars of silver-lead ore, yielding respectively $179, $147 and $125 per ton, with returns from the fourth not yet received. Lessee Hartan, on the Bachelor, is also said to have shipped a car of ore which brought $1300, and Ryan Humphrey, on the Wedge, a $1000 car.

Kansas

Diplomat—This mine, at Galena, A. M. Gaines, manager, hoisted an average of over 1000 cans of ore from one shaft for the entire week, a total of 3215 tons.

Elinita—The mill of this company, at Galena, has been sold to O. W. Sparks, who will move it to Badger.

Kentucky

Coil—An explosion of gas in this company's mine, at Madisonville, on Apr. 21, killed five men, all that were in the mine.

Michigan

COPPER

Franklin—Operations are being centered in No. 1 shaft in lateral openings between the 26th and 32nd levels and the shaft has reached the 33rd level where the lode will be opened by crosscutting. The rock going to the mill is running about 20 lb. mineral per ton. At the 23rd level a drift is being extended to connect with No. 3 shaft and when this shaft is reached it will be opened both by sinking and raising from this point. No. 3 shaft is now bottomed at the 16th level.

Adventure—Work has progressed through the copper-bearing lode that was encountered recently in the crosscutting from No. 5 shaft. The formation is about 30 ft. thick and is mineralized throughout. The identity of the formation has not been determined.

Houghton—This company is drifting at the 645-ft. level, and is opening uniform and mineralized ground on the main lode. Little work has been done on the West lode.

Oneco—Shaft-sinking has reached a depth of about 1180 ft.; some copper has been in evidence occasionally, but no lateral work has been done, other than station cutting every 100 ft. When the shaft is 1220 ft. deep, opening will be started at several points, and the formation, which revealed rich drill cores, will be explored.

Wyandot—The long exploratory crosscut is being continued eastward to the sandstone, and drifting has been started in both directions on No. 8 lode, which was highly mineralized at the point of intersection.

Calumet & Hecla—The company has announced a 10% increase in wages to all employees, subsidiary companies included, to take effect May 1. Other large producers in the district are expected to take similar action.

Copper Range—Following the example set by the Calumet & Hecla, the company has announced a 5% increase in wages.

IRON

Rogers—At this new Rogers-Brown mine, east of Iron River, the 11x16½-ft. shaft has been continued to the second level. At the first level, 330 ft. below the collar and 200 ft. in rock, a crosscut is being driven east to the orebody, which cuts across the property in a northeast direction, and a pump station cut on the first level just north of the shaft. The water is giving little trouble, only about 80 gal. per min. being pumped. Creosoted timbers have been used in the shaft. The contractors are starting to erect the steel and brick buildings. The foundations for the boilers are set and a concrete base has been completed for the steel smokestack, which will be self-supporting, 8 ft. inside diameter and 150 ft. high.

Huron Iron Mining Co.—The Groveland mine of this company, north of Iron Mountain, is closed down temporarily. Work continues at the McDonald exploration, at Crystal Falls.

Minnesota

Great Northern Ore—It is reported that after conferences in the East, D. M. Philbin, recently placed in charge of these properties, announced that arrangements will be made with independent operators on the Mesabi Range for the working of the Great Northern properties after the termination of the Steel Corporation's lease.

Missouri

Katy—This mine, at Thoms Station, sustained a bad cave in the old workings recently. It will not interfere with the working of the mine, as drifts were already cut around this portion.

Ray—This mine is on the land of the General Lead & Zinc Co., at Thoms Station, and is producing lead in chunks of 300 and 400 pounds.

Sycamore—The mine, on the Rex tract, at Joplin, has been purchased for $10,000, by T. F. Coyne, of Webb City.

Smithfield—This mill, at Webb City, has been purchased by Andrew McInturff, who will erect it on the Aylor tract.

Falls City—Pate & Poindexter will erect a 250-ton mill on their lease from the Falls City Co., west of Joplin.

Chicago-Lehigh—A. F. Dexter, of Chicago, has purchased the lease of Charles Wells, at Lehigh; he has drilled it thoroughly and will move the Culpepper mill from Webb City and erect it on the property.

Birthday—This company, at Spring City, will erect a mill on its land.

ST. FRANCIS COUNTY

The threatened strike in the disseminated lead belt has been eliminated by a general increase in wages, the underground men being advanced 25c. per 8-hr. shift and the surface labor 15c. The advance takes effect May 1, and will increase the pay rolls about $37,000 per month.

Montana

BUTTE DISTRICT

Davis-Daly—The Colorado shaft has reached 1850-ft. depth, and will be advanced to the 2000-ft. level before a stop is made. At 1800 ft., a rich vein of zinc ore was intersected; it had a width of about 3 ft. where cut, and assayed 44% zinc. A vein was recently cut on the 1700-ft. level, averaging about 10% copper, and shipments of ore are being made from there regularly. By an arrangement with the Anaconda company, a crosscut is being driven from the Gagnon mine on the 2000-ft. level to develop the western end of the Davis-Daly property.

Ophir—On the 500-ft. level, an east drift recently intersected a cross fissure carrying good silver ore. Another drift on the south vein on the same level ran into an orebody some time ago, and about 100 ft. of drilling have disclosed ore carrying gold, copper and zinc. The contract for the erection of the steel work of the new concentrator has been let to the Colorado Iron Works, of Denver, and the Westinghouse company has been given the contract for the electrical equipment.

BEAVERHEAD COUNTY

Butte & Vipond—Plans are being made to begin operations on a group of claims near the Hecla mine. This company was organized about a year ago by Butte and New York men, Thomas P. Manley, of Butte, being president. A crosscut will be driven south on the 200-ft. level, and it is expected to tap the vein within 250 ft. The company owns a mill site and will erect a mill when sufficient ore has been blocked out.

FERGUS COUNTY

The camp of Kendall, where the North Moccasin mine is situated, is gradually being deserted, and the last of the mercantile establishments has been moved to the neighboring town of Hilger. The Kendall mine is the only one still operating there, and with but a fraction of the original force. The North Moccasin has become so tied up in litigation that it is probable that it will be idle for some time, though the Kendall company has repeatedly offered to take it over. With the reopening of this mine, the town will probably revive.

JEFFERSON COUNTY

Boston & Corbin—Negotiations have been closed for the sale of 10,000 shares of the company's stock at $8 per share, less a commission of 50c. per share. This is expected to provide $75,000 to construct a 200-ton concentrator. Stockholders on May 6 will vote on the matter.

Montana-States—The Montana-States Mining Corporation has been organized by Helena men, with a capitalization of $5,000,000, par $5, to develop a tract of nearly 700 acres of land, six miles east of Alhambra. The officers are: Robert A. Bell, of Helena, general manager; Henry C. Smith, justice of the supreme court, president; Dr. Rudolph Horsky, vice-president; Edward Horsky, secretary and treasurer; the main office is in Helena.

LINCOLN COUNTY

Blacktail—This gold mine, in the West Fisher district, 35 miles from Libby, will be ready to operate June 1, according to Manager A. M. Balfour. The mill was damaged by a snowslide during the winter and this has delayed operations.

Nevada

Comstock Lode

Mexican—A shipment of 1300 lb. of bullion was made last week, estimated to be worth $30,000. Stoping has been resumed, and the north ends of the stopes on the 2300- and 2400-ft. levels are now being opened. The recovery from these levels last week was 30 tons averaging $17.45 and 115 tons averaging $18.56.

Crown Point—Run No. 5 at the Yellow Jacket mill of 4400 tons, netted the company $22,000. Run No. 6 is now underway. Stoping contines on the 1400-ft. level, and the last week 628 mine cars of low-grade ore were extracted.

Ophir—The net smeltery returns on the cleanup from 2000 tons of ore milled at the Kinkead mill were $55,700. The company had a balance of $63,000 on hand in the treasury on Apr. 1, with all bills paid.

C. & C.—The three new centrifugal pumps have been grouted to their foundations on the new 2310 station, and the suction and discharge pipes and valves installed.

Union Consolidated—From the 2 ft. of quartz cut in the east crosscut, six mine cars of ore were saved, assaying $21.12 per ton. This streak will be followed when the crosscut is connected with the west crosscut from the joint Union and Sierra Nevada winze. In the Patton crosscut, a 2-ft. quartz vein has been found, giving assays of $12.90 per ton. This prospect will be developed.

Humboldt County

The two producing mines in the Seven Troughs district produced about $300,000 worth of ore in 1911, a considerable portion of which is reported to have been profit. Ore reserves are said to be sufficient for some time yet.

Developments at the quicksilver properties in American Cañon, about 25 miles northeast of Lovelock, are reported to be satisfactory to the operators and some good specimens of massive cinnabar were recently exhibited as coming from Walker Brothers mine which is shipping regularly.

Boyer—This copper mine in the Table Mountains, in which Carpenter Brothers, of Denver, are interested, is planning to resume operations soon.

Nye County

Shipments in tons from Tonopah mines to date and for the week ended Apr. 11, are as follows:

Mines	Week	Year to Date
Tonopah Mining	3,150	49,319
Tonopah-Belmont	1,750	32,426
Montana-Tonopah	1,053	14,977
Tonopah Extension	1,012	14,022
West End	600	10,349
Midway	.....	180
MacNamara	390	4,497
North Star	.....	40
Totals	7,955	125,810
Estimated value	$198,875	.....

Tonopah-Belmont—During March, 8047 tons of ore were milled and 562 tons were shipped to the smeltery, with gross returns of $230,882; the net profit for the month was $146,628.

Montana-Tonopah—The orebodies continue to develop satisfactorily. On the 565-ft. level, the new vein is 22 ft. wide between walls; 8 ft. of this average $108 per ton, and the remainder from $30 to $35 per ton. On the 615-ft. level, another new vein is 3 ft. wide and averages $120 per ton. An important development is on the lowest level, where the Macdonald vein, 1000 ft. west of the main shaft, is being sunk on in trachyte, indicating new possibilities at depth in this section of the mine.

Tonopah Extension—The oreshoot on the 400-ft. level is from 5 to 20 ft. wide and about 90 ft. long; it has been opened up on the 500-ft., and due to the dip of the vein, this gives 180 ft. of "backs."

Tonopah Mining Co.—During the year ended Feb. 29, 1912, 174,685 tons of ore were milled and treated, averaging 0.286 oz. gold, and 26.05 oz. silver, or $19.97 per ton, or $2.01 per ton less than the average for the previous year. Since commencement of operations, opening work of all kinds, including 7278 ft. of core drilling has totaled 146,181 ft., or 27.68 miles.

White Pine County

Giroux—Rich ore carrying chalcocite, native copper and cuprite, is reported to have been opened on the 90-ft. level of the Bunker Hill shaft.

Nevada Consolidated—During the 15 months ended Dec. 31, 1911, the net production of copper totaled 78,541,270 lb., at a cost, after providing for depreciation and all other charges, of 6.97c. per lb., as compared to 7.05c. for the year ended Sept. 30, 1910. The average price received for copper was 12½c. per lb. The reserves on Jan. 1, 1912, were 40,853,371 tons of 1.662% copper ore as compared with 40,360,823 tons of 1.70% on Oct. 1, 1910. The State Railroad Commission has served notice on the Nevada Northern Ry., owned by this company, that the entire schedule of freight and passenger tariffs are believed to be unreasonably high and will be investigated. As an illustration, the fare of $8 for 140 miles, from Ely to Cobre, is quoted.

Coppermines—The Gunn-Thompson interests, owning these mines in the Ely district, which have been idle for three years, have decided to resume operations. Arthur Smith is general manager and Henry Smith mine superintendent. The Minnesota mine separates the Butcher Boy claim of the Coppermines company from the Nevada Consolidated.

New Mexico

Grant County

Cleveland—George H. Utter, owner of this group of claims, left for Denver recently, to purchase new machinery for his mill, eight miles north of Silver City. The present machinery has accomplished the purpose for which it was installed, that of demonstrating the practicability of concentrating the ores profitably. The plant will be replaced to meet commercial requirements. A new crusher and rolls will be installed, also some trommels and additional jigs. The plant will be made modern and will be operated for 24 hr. per day. During the last month three cars of concentrates were shipped to Oklahoma smelteries.

Socorro County

Ernestine—The first 10-day cleanup in April yielded 8470 oz. of gold and silver bullion and 10,000 lb. of high-grade concentrates; 742 tons of ore were treated during a recent week.

Oaks—A total of 35 ft. of development was done at the Pacific mine during the week, from which 42 tons of ore were packed to the Deadwood mill. Work continues in the main drainage and transportation tunnel.

Deep Down—The winze from the tunnel is being sunk with two shifts, in a good grade of mill ore.

Socorro—More than 5000 tons were treated in March. About 93% of the gross content of the ore is being recovered by concentration and cyanidation.

Treasure—Mine developments are satisfactory and stopes of good ore are being opened in what was formerly virgin ground. The mill on Whitewater Creek handles about 400 tons per week.

Johnson—Current work has disclosed good gold and silver ore and the extent of the orebody is now being determined.

Oklahoma

Prairie State—This company, at Hattonville, has bought a mill to erect on its property.

Chapman & Lennan—The Red Dog mill will be moved from Webb City, Mo., to the mine, at Hattonville.

Oregon

Baker County

North Pole—Active development is going on in addition to stoping. The stamp mill is operating 30 of its 40 stamps, on satisfactory ore. Shipments of high-grade crude ore are also being made.

Red Boy—The 20-stamp mill is reported to be running on $13 ore. A tube mill is being installed.

Columbia—The mine continues to produce about 60 tons per day.

Ben Harrison—Work during the winter

is reported to have opened good orebodies, and it is said that the company will move a mill from an Arizona mine. and install it here this summer.

South Dakota

Black Hills District

Trojan—The cyanide plant is still operating one unit, but as the weather has improved, it is proposed to make an effort to start the other unit. This will give the plant a capacity of at least 300 tons per day. Considerable other work is planned, including the construction of a machine and repair shop. H. S. Vincent is general manager and Charles E. Ellis, formerly with the Mogul company, is mill superintendent.

Utah

Beaver County

Sheep Rock—It is the intention to resume operations at the 10-ton mill in May. The average milling ore runs $30 per ton, and the shipping ore between $100 and $200, chiefly in gold. Drifting is being done on the 60-, 100- and 110-ft. levels.

Juab County

Tintic shipments for the week ended Apr. 12 were 184 cars.

Opohongo—Shipments are being made at the rate of four cars per week, averaging $1000 per car. One car, shipped in March, brought $2874. The company has never levied an assessment.

Chief Consolidated—The March output amounted to 62 cars exceeding February by 10 cars. It is said that April shipments will be somewhat lower, but that the grade of the ore is satisfactory. The output for the first quarter of the year amounted to 146 cars. Conditions at the mine are encouraging, and there is a good surplus in the treasury.

May Day—Work is being done on the 700-ft. level in two faces of ore. Just below the 1000 ore has been opened, which is thought to be a continuation of the orebodies at present productive on the 400 and 700. The width of the ore, which is of good grade, is given as 6 ft., and the thickness as four feet.

Uncle Sam—Some ore is exposed in this property, which is more than making expenses.

Yankee—The mine has resumed its usual shipments of dump ore, as the condition of the roads has improved.

Iron Blossom—Shipments of 45 cars per week are being made, and the company is said to be earning about $75,000 per month. The ore, which is siliceous gold-silver ore, averages $10 per ton net. The electric hoisting machinery for No. 1 shaft has arrived in Tintic, and will be hauled to the mine in a few days. The new equipment will make it possible to undertake development on the 1900-ft. level and at greater depth.

Swansea—The oreshoot recently discovered on the 940-ft. level and later lost, is reported to have been reopened. It is stated that the company is contemplating taking an option on the adjoining property of the Picnic Mining Co. With 200 ft. of drifting from the Swansea a vein, in the past productive of rich ore on the surface of the Picnic, will probably be cut at a depth of 900 feet.

Emerald—The Opex equipment has been leased to this company and work continues through the Opex shaft.

Salt Lake County

Utah Metal—The tunnel, being driven to connect the Bingham and Tooele sides of the Oquirrh Range, has attained a length of approximately 8475 ft., being in 1075 ft. from the Bingham side and 7400 ft. from the Tooele side. The average progress is 60 ft. per week. The property comprises 3400 acres extending from Carr Fork in Bingham, over the Oquirrh Mountains into Tooele County. The capitalization is 1,500,000 shares, $5 par value.

Bingham Mines—It is estimated that net earnings for the first quarter of 1912 will exceed $40,000. The March output of copper and lead ores from the Commercial and the Dalton & Lark amounted to 114 cars, and the February production to 121 cars. The Eagle & Blue Bell is shipping at the rate of about 24 cars per month.

Alta Consolidated—According to an official of the company there are 3000 sacks of high-grade ore ready for shipments, which are now to be made regularly.

Summit County

Park City shipments for the week ended Apr. 15 amounted to 4,859,020 pounds.

Thompson-Quincy—The raise, which is being driven from the 1600-ft. level for the limestone-quartzite contact, is up 300 ft., and shipping ore is reported in the top. The 1600-ft. level is the 1200 of the Daly West.

Daly West—Work is being done on the 900, with the limestone-quartzite contact in sight. Milling operations suspended owing to the freezing of the water supply, have not been resumed. Development continues at depth, and steady shipments of ore are being made. March shipments amounted to 2919 tons.

Virginia

Piedmont Manganese Corporation—Plans have been made to start work at this company's mine, eight miles east of Lynchburg, recently purchased by a syndicate headed by N. R. Livingston, of New York, and D. W. Myers, of Lynchburg. It is reported that the plant will cost about $300,000.

Canada

Ontario

Gould Consolidated—Vein 146 of the Nipissing has been cut on this property at the 100-ft. level. The lowering of Cart Lake has uncovered for surface prospecting a large area belonging to the company.

Mann—The returns from 15 tons of high-grade ore, shipped from this property at Gowganda a few weeks ago, were over $38,000, $6000 being about the expense of mining and marketing the ore.

Ontario-Cobalt

Shipments of ore and concentrates, in tons, from Cobalt for the week ended Apr. 19, and for the year to date, are:

	Week	Year
La Rose	95.98	998.28
Coniagas	.....	546.35
O'Brien	.....	199.78
Right of Way	.....	110.30
Chambers-Ferland	33.60	129.60
McKinley-Darragh	53.54	842.65
Nipissing	.....	473.12
Hudson Bay	31.48	249.88
Buffalo	28.17	322.38
Crown Reserve	.....	149.11
Cobalt Townsite	.....	320.31
City of Cobalt	32.70	145.84
Trethewey	.....	147.06
Colonial	.....	20.00
Kerr Lake	.....	231.48
Cobalt Lake	.....	136.01
Drummond	.....	300.32
Temiskaming	.....	260.37
Beaver	.....	101.99
Wettlaufer	.....	111.21
Provincial	.....	22.22
Casey Cobalt	.....	24.50
Totals	275.47	5,842.52

Bullion Shipments in Ounces

Mine	Week	Year to Date
Buffalo	6,168.00	31,438.00
Kerr Lake	2,244.50	4,566.25
O'Brien	20,662.00	72,834.47
La Rose	20,636.00	.....
Temiskaming	2,522.50	56,833.00
Drummond	1,198.70	.....
Total	53,231.70	.....

La Rose—During 1911, 3429 tons of ore containing 3,691,797 oz. of silver were produced at a cost of 19.2c. per oz. On Dec. 31, 1911, the ore reserves amounted to 4,250,861 oz. and the combined surplus was $1,551,420. The average price received for the year for silver was 53.55c. per ounce.

Nipissing—The report for the year ended Dec. 31, 1911, shows a total production of 5,197,042 oz. of silver at an average cost of 13.95c. per oz. On Jan. 1, 1912, the high-grade ore reserves exceeded in value those of 1910 by over $275,000, and total reserves were worth $4,572,000. About 270 acres remain unprospected.

Trethewey—Since its incorporation and up to Dec. 31, 1911, the company has earned net profits of $932,961, and has paid out $761,998 in dividends. During 1911, development work totaled 3071 ft., a large part of which is said to have been unprofitable but necessary crosscutting. The amount of ore placed in sight during the year is about equal to that mined, according to Charles A. O'Connell, manager.

Right-of-Way—During 1911, the company mined $156,588 worth of ore and the year closed with a net profit of $59,030. Profit and loss account now amounts to $70,348. Since Jan. 1, the company has secured an option on a silver property in the Port Arthur district. The ore reserves are becoming worked out, but the dumps contain about 8000 tons of ore which are expected to run from 15 to 20 oz. per ton.

ONTARIO-PORCUPINE

During the last week two new mining companies having an aggregate capital of $2,000,000 were incorporated.

Porcupine Gold—The designs for the 100-ton mill are now ready and construction work will be started soon. A 3-ft. quartz vein apparently carrying good milling ore, has been found in crosscutting from No. 2 drift at the 100-ft. level.

Dome—This mill is getting an extraction of over 97%. The management plans to do 10,000 ft. of underground work in the next year. The working of the mill is regarded locally as demonstrating the fact that Porcupine ores can be handled by the free-milling process. Two cleanups per day are made.

Porcupine Lake—This property is being prospected with two diamond drills which are set up on the ice on Porcupine Lake.

Standard—The directors' report presented at the annual meeting in Montreal, Apr. 11, showed that the company was in debt and that operations had not disclosed any valuable orebodies. The directors were authorized to issue preferred shares, or adopt other means to raise funds for further development.

Hollinger—Some delay in the construction of the mill has been caused by legal proceedings in the United States against makers of parts of the machinery, on the ground of infringement of patents. The completion of the work before June 1 is not likely.

Swastika—The report for 1911 shows that $63,722 were spent on development and prospecting, and the year closed with a cash balance of $10,713. Total receipts were $149,272. Gold recoveries amounted to $4248 and gold bullion worth $3882 was on hand Dec. 31. R. B. Lamb, consulting engineer, states that during the latter part of 1912 the company should become self-sustaining.

ONTARIO-WEST SHINING TREE

Dalton-Thomas—On this group of 15 claims, camp buildings have been erected and stripping done on the dike for 200 ft., some surface samples running $2.80 per ton.

Moore & McDonald—On this group of six claims, lying south of the Gosselin, a shaft sunk for 20 ft. shows free gold in places. The veins have been stripped on the surface showing a width of 35 ft. for a distance of 550 feet.

Gosselin—A shaft is down 40 ft. and veins have been traced to the surface and stripped for 700 ft., showing a width of 10 ft. with some free gold. Development will be pushed at the 50-ft. level. Diamond drills are on the way to the property.

QUEBEC

Robertson—The property of this asbestos company is being sold by the trustees for the benefit of the bondholders. The company's mines are near Thetford, in Quebec. Like many others, the results of competition and the lower prices have been felt keenly.

Mexico

CHIHUAHUA

The following mines shut down in March: West Mexican, La Fe, Minas de Oro, Los Angeles and Cherokee Goldfields, Ltd.

Bazonopa—A discovery of free-milling gold ore was made recently in the vicinity of the Poche vein.

Sierra Plata—In March, work was still in progress at this mine, under charge of R. H. Allen.

Tepehuan Mexican Syndicate—The closing of this mine marks practically the cessation of all active mining operations in the vicinity of Sierra Madre.

Alvarado—The company is planning extensive development which will probably result in all the mines of the Presena group becoming one large mine. The ore will go to the Alvarado mill over the new aërial tramway.

MEXICO

Esperanza—The Guggenheim Exploration Co. has disposed of its entire holdings in, and will sever all connection with, this company. The control will revert to London. During March the mill crushed 16,640 tons of ore. Gross receipts were $123,672; working expenses, $94,522; depreciation, $5000; other expenses, $1108; estimated profit, $21,734. Development work totaled 1352 ft. Additional drifting has been done north and south on the San Carlos vein, together with raising. The ore averages about 5 ft. wide and over 1 oz. gold.

SAN LUIS POTOSI

Tiro General—This mine, at Charcas, is replacing a 15-km., narrow-gage railroad with track of standard gage. Ore shipments amount to about 200 tons per day, and about 1200 men are employed. S. F. Shaw is superintendent.

SONORA

Cananea Consolidated—The company recently placed an order for two Sterling boilers. The boilers will be equipped with superheaters.

Mesa Rica—This mine, 35 miles northeast of Sahuaripa, closed down recently and the Americans have left for the States.

Creston de Cobra—The company recently installed new machinery at this mine, 30 miles west of Hermosillo, including a 90-hp. Ingersoll-Rand compressor and five drills. A 50-ton concentrating plant is in course of erection. The main shaft has been sunk to 500 ft. and good ore is reported to have been found.

Newfoundland

Great Northern Copper Co. — This company has recently been merged with the Notre Dame Copper Co. and the Hodder Supply Co. These are Pittsburg companies with mines at Twillingate, Newfoundland.

South America

CHILE

Braden—The company is producing over 700 tons of refined copper per month. The experimental plant being installed by the Mineral Separation Co., Ltd., is expected to be ready about June 1. It is understood that while the Separation company is installing this at its own expense, the Braden company agrees to use it if the recovery averages 85 per cent.

PERU

Caylloma—The company owning these silver mines has been reorganized as the Sociedad Explotadora de Caylloma Consolidada, with a capital of £100,000 in 400,000 shares of 5s. par. Good ore is reported to have been found in No. 5 level. In the Santa Cata shaft the electric pumps have been delivering over 90 tons of water per hour from the No. 6 level. Two similar pumps are *en route* from Europe. The railway and mill have been stopped temporarily and development of the San Cristobal lode to No. 8 level is being pushed. The Flor del Mundo drainage tunnel is being driven at the rate of 28 meters per month. This is expected to be increased to 40 meters with larger air drills. Alfred Fox, general manager, recently returned from Europe and is in charge at the property.

Asia

CHOSEN

Oriental—During February, 22,092 tons of ore were crushed, yielding $119,860 gross and net $45,936. Operating costs were $69,873; operating profit, $49,987, and $4050 were put back into improvements. The Kuk San Dong 40-stamp mill was hung up for the full month because of labor shortage.

RUSSIA

Lena Goldfields—Dispatches state that 107 miners were killed and 80 wounded in a fight with Russian soldiers at the mines of this company at Irkutsk.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Apr. 24—The coal trade is still dependent almost entirely on labor conditions. A large proportion of the mines are still idle and trade suffers in consequence.

In the West the various districts conferences are gradually settling the new schedules and many mines are resuming or preparing to resume operations. Trade is rather slow, as many large consumers are still using stocks accumulated in anticipation of a suspension. With the new supplies coming into the market and the shipments from West Virginia and Kentucky, there is, apparently, sufficient coal to provide for present needs. Business is improving, however, and the prospect is for a good demand.

The seaboard bituminous trade is well supplied and is rather dull for the time being.

The anthracite wage conference still continues, the prospect being for the arrangement of a working compromise. No coal is being mined and the belief is that, even if a settlement is reached, it will be well on in May before the mines are reopened. Stocks are nearly exhausted and already there is a shortage of several sizes, both of domestic and steam coals. Another week or so will bring an urgent demand. Meantime the trade is altogether unsettled and uneasy.

Coastwise shipments of coal from chief Atlantic ports, two months ended Feb. 29, long tons:

	Anthracite	Bituminous	Total
New York	3,044,154	1,763,363	4,807,517
Philadelphia	319,294	529,078	848,372
Baltimore	36,461	514,674	551,135
Newport News	.....	449,876	449,876
Norfolk	.....	817,817	817,817
Total	3,399,909	4,074,808	7,474,717
Total, 1911	2,873,887	4,241,755	7,115,642

Increase this year in anthracite, 526,022; decrease in bituminous, 166,947; total increase, 359,075 tons, or 5%. Norfolk includes Sewells Point. New York covers all the harbor shipping ports, including barge deliveries to city and nearby wharves.

British Coal Trade—Exports of fuel from Great Britain, three months ended Mar. 31, long tons:

	1911	1912	Changes
Coal	15,201,352	12,473,072	D. 2,728,280
Coke	251,671	277,123	I. 25,452
Briquettes	425,246	373,332	D. 51,914
Total exports	15,878,269	13,123,527	D. 2,754,742
Steamer coal	4,701,509	4,051,302	D. 650,207
Total	20,579,778	17,174,829	D. 3,404,949

Imports of coal for the three months were 3341 tons in 1911, and 24,269 in 1912; increase, 20,928 tons.

Iron Trade Review

New York, Apr. 24—The iron and steel markets continue active, and the tendency to higher prices is becoming more marked, though the advances are small.

In finished material a heavy business has been done in bars by the agricultural machine makers. Their contracts have been generally closed on the base of 1.15c. Pittsburg, coming in before the recent advance to 1.20c. was made. In structural material a good business has been done; while plates are in demand, owing to the number of new orders for cars. Generally the mills are full and are showing no special anxiety for new orders.

In pig iron sales have been active. Basic pig seems to be in strong demand and many orders are reported. Foundry-iron sales are improving, and prices are a little better than they have been. Southern makers are seeking better prices for second-half deliveries. There is still much competition for good orders and this prevents any considerable advances. There is, however, undoubted firmness on the present basis.

The Bethlehem Steel Co. proposes to authorize an issue of $60,000,000 in first-mortgage 5% bonds, of which $15,000,000 are to be issued soon to pay for new work, improvements and additions to the plant.

Hearings are in progress before the Interstate Commerce Commission on the complaint filed by the Pittsburg Steel Co. and others, charging that the rates on iron ore from Lake Erie ports to the Pittsburg district are too high, and that they discriminate against the independent companies by reason of the ownership of railroads by the Steel Corporation.

Baltimore

Apr. 22—Exports for the week included 3,342,550 lb. rails and 265,758 lb. rail-joints to Tampico, Mexico. Imports included 6550 tons manganese ore from Bombay, India; 5550 tons pyrites from Huelva, Spain; 5900 tons iron ore from Cuba.

Birmingham

Apr. 22—The Southern pig-iron market is very strong, the sales being steady and the price firm with an indication of taking on an advance in the next week or so. Pig iron for delivery during the third quarter of the year is selling at $11 per ton, No. 2 foundry, while inquiries for iron for the last quarter are being answered with a 50c. advance on this price. There have been some sales made recently for delivery during the last of the second quarter of the year at $10.50. Some of the larger consumers have purchased quite freely. The make in Southern territory has not yet been improved, though this will be a necessity within the next 60 days if the demand continues.

Cast-iron pipe demands warrant a steady operation of plants and the output is large. The shipments are equal to the make right along. Charcoal iron is in fairly good demand with the make low. The price remains firm at $22@22.50. Scrap iron is in better demand also.

Chicago

Apr. 23—The pig-iron market continues quiet but strong. For last-half deliveries there has been a steady demand in the last week, with inquiries increasing and a number of large tonnage requirements under negotiation. The situation is better than it was a week ago, for nearly all sellers of pig iron. Southern No. 2 holds firmly to $10.50, with some sales made at $10.75, Birmingham, or $14.85 Chicago minimum price, the freight being $4.35. Northern No. 2 is quoted at $14 minimum at the furnaces, with sales up to $14.50. The demand is active for both Southern and Northern, the latter holding somewhat more steady because of the need of it in mixtures. Northern charcoal is also in very good demand, at $16.50, minimum.

In the finished products market both structural material and railroad supplies are in larger demand, though neither has anything of a boom. Railroad buying still lags generally. Bars are selling at uneven prices, but representatives of local mills assert that little business is being done from Pittsburg and that the nominal minimum of 1.33c. is being obtained. Plates are selling well; sheets and wire goods are in better demand than a week ago. Encouraging conditions are reported in almost every line, the bar sellers perhaps showing least optimism.

Cleveland

Apr. 22—Moderate sales of Lake ore are still being made, but the bulk of the business seems to be closed.

Pig Iron—A number of sales are reported and the market has been active. Some large lots of basic are reported

sold at $12.50@12.75, but Valley furnaces hold at $13. Bessemer is $15.15; No. 2 foundry, $13@13.50; forge, $12.50 @12.75, Cleveland delivery.

Finished Material—Some large contracts have been placed for bars and plates. Some of the bars were taken at 1.15c., but 1.20c. is now the general price. Sheets are active and firmer in price.

Philadelphia

Apr. 24—All grades of pig iron have been selling well during the week, mostly for early delivery, and consequently the transactions were generally for small lots. Low-grade iron has led in quantity and ready stocks are practically exhausted. Much business for low-grade iron now in sight will probably go southward, where already some very heavy transactions have been closed. The coal and coke situation has unsettled calculations of buyers and makers and the possibilities of a railroad strike have been an unsettling influence for the past week. Foundry irons are pretty well cleaned up for early delivery and makers are less anxious than a while ago to contract for third quarter. Forge irons are stronger than for a month, while basic and malleable are moving more freely. The outlook for pig is better than for some months and if two or three disturbing factors clear up it is believed that the heavier consumers will cautiously proceed to cover the probable requirements pretty well up to the close of this year. Sales of No. 2 X foundry are reported at $15@15.25 with Virginia iron selling from 50c. higher. Gray forge readily brings $14.50 and basic is strong at $15 per ton.

Steel Billets—A good deal of long-pending business in billets has been recently closed which puts the manufacturers in better position than for some months. Forging billets have become especially active. Rolling billets are $22.40 @23.40, tidewater.

Bars—Bars are strong at 1.27c. minimum, delivered, with a moderate business in steel bars at 1.30c., at which a large business has been shoveled in, in anticipation of another advance.

Pipes and Tubes—Notable development has taken place in tubes and the current demand is well maintained.

Plates—The advance in steel plates has had a stimulating effect upon the market, especially in view of the probability that it is not the last advance. Steel plates are quoted 1.30@1.35c. The outlook is favorable for some heavy plate business.

Sheets—The sheet mills are rushing to the limit of capacity in most mills to clear their books for later business.

Structural Material—The week's orders are of moderate proportion. The quiet will be of short duration. There is enough business half through and which will be announced shortly, to send structural quotations after steel plate. Quotations 1.30 @1.35c., tidewater.

Scrap—The scrap market continues active in nearly all kinds. Heavy melting steel, No. 1 railroad and heavy cast are taking the lead at practically the figures named by dealers.

Pittsburg

Apr. 23—The disposition of the steel mills to advance prices continues, and since last report the majority of mills have made advances in bars from 1.15 to 1.20c. and in plates and shapes from 1.20 to 1.25c. There is good reason to believe they will make a further advance in plates and shapes to 1.30c., and on this level they will likely rest, awaiting with such equanimity as they can command the development of third-quarter business. Buyers are heavily contracted to July 1, contracts permitting specifications to be filed up to that date, at prices generally ranging from 1.05 to 1.10c. for bars and from 1.10 to 1.15c. for plates and shapes. With prices so much above this level, specifications will naturally be heavy and buyers may specify little material on the new contracts. This might effect a lull in midsummer, but there are confident predictions that within the next 60 days the railroads will appear as large buyers, and this would save the situation.

Pig Iron—The market has been quiet and while in general the market shows a firm undertone, there was a sale of bessemer last week which disclosed an unaccountable weakness. The sale was 300 tons at $14.15, Valley, by one of the largest producers to a steel-casting interest in the Pittsburg district, when the market on all hands was admittedly $14.25. In the circumstances the sale attracted much attention. We quote: Bessemer, $14.15@ 14.25; basic, $13; No. 2 foundry, $13.25; malleable, $13; forge, $12.75, all f.o.b. Valley furnaces and 90c. higher delivered Pittsburg, for near-by delivery.

Ferromanganese—The market for forward delivery is firm at the advance of $2.50 reported last week, while small prompt lots are bringing still higher figures than formerly. The total turnover, however, in both prompt and forward, is relatively small. We quote forward at $43.50 and prompt at $45@48, f.o.b. Baltimore.

Steel—Very little steel is available and the market is at a standstill. Consumers are well covered to July 1, but in many cases are complaining of deliveries, while they cannot well eke out by purchases of prompt material as prevailing prices are so much above contract. We quote billets at $20 and sheet bars at $21, Pittsburg, but it is doubtful if much could be picked up at these figures. The market will probably soon open for third quarter, and $22 for sheet bars has been mentioned by one or two producers, but sheet mills do not see their way clear to pay the price as they are not realizing enough for their sheets. Rods are $25, Pittsburg, and very quiet.

Sheets—The market has advanced fully $1 a ton, by independents withdrawing their lowest price and thus getting the market nearer the minimum prices announced by the leading interest on Apr. 11. If any black sheets are available below 1.90c. the case is altogether exceptional, while the minimum of the leading interest is 1.95c. Galvanized sheets are similarly quotable at 2.90@3c., and blue annealed at 1.35@1.40c. We quote painted corrugated roofing at $1.35 per square and galvanized at $2.55. The leading interest's innovation, in quoting this material by the pound, has met with a very hearty reception and the practice is likely to become general. Its extras are 5c. per 100 lb. for corrugating, with an additional 15c. for painting gages 25 to 28 inclusive.

St. Louis

Apr. 22—The demand for pig iron seems to be better than at any time this year. Owing to the increased call, prices have been advancing, although very little business as yet has been done at the new figure. The iron trade on the whole is more optimistic and the demand for finished steel products is much better. Iron buyers seem a little more inclined to buy further ahead than heretofore; however, this is only a natural inclination on an advancing market. Southern No. 2 foundry is quoted at $10.75@11, Birmingham, or $14.50@ 14.75, St. Louis. The bulk of the demand is for Southern iron. Northern iron is being quoted at around $14.50 per ton.

Good foundry coke is bringing $5@5.15 per ton, St. Louis.

Iron Ore Trade

Sales of Lake ore continue, but rather slowly. Heavy chartering of vessels has been completed at 40c. from Duluth to Lake Erie, 35c. from Marquette and 25c. from Escanaba, these rates excluding the unloading charge.

The first train load of ore from the Mesabi arrived, Apr. 15, at the Great Northern docks, at Superior.

It is said that Spanish nonbessemer ore is now being offered to Eastern furnaces at 7c. per unit, delivered, notwithstanding the higher freights.

In the East, New Jersey and New York ores are selling on a basis of about 7c. per unit, delivered. Lake Champlain ores have been contracted for at 7¼@8c. per unit, on canal boats at Port Henry, according to grade. Newfoundland ores bring 7c. per unit on dock. The small quantity of Cuban ores sold on the open market brings the same price.

German Iron Ore—Imports of iron ore

in Germany, two months ended Feb. 29, 1,616,995 metric tons; exports, 362,245 tons. Imports of manganese ore were 50,451; exports, 1561 tons.

British Iron Ore—Imports of iron into Great Britain, three months ended Mar. 31, were 1,889,637 long tons in 1911, and 1,609,648 in 1912; decrease, 279,989 tons. Imports of manganese ore, 101,060 tons in 1911, and 69,552 in 1912; decrease, 31,508 tons.

Foreign Iron Trade

French Iron and Steel—The *Comité des Forges* reports production in France for the year ended Dec. 31 as below, in metric tons:

	1910	1921	Changes	
Pig iron	4,000,721	4,410,866	I.	410,145
Steel ingots	3,390,309	3,668,678	I.	278,369
Billets	1,597,803	1,696,635	I.	98,832
Bars and shapes	1,158,760	1,305,492	I.	146,731
Plates	406,291	462,681	I.	56,390
Rails	372,691	451,697	I.	79,006

The reports of finished iron and steel are not complete.

German Foreign Trade—Exports and imports of Germany, two months ended Feb. 29, metric tons:

	Exports	Imports	Excess	
Iron and steel	959,442	102,857	Exp.	856,585
Machinery	75,118	10,237	Exp.	64,881
Total	1,034,560	113,094	Exp.	921,466
Total, 1911	856,248	95,224	Exp.	761,004

Increase in exports this year, 178,312 tons; increase in imports, 17,850 tons.

Steel in Germany—Steel production in Germany in 1911 was: Acid, 571,254; basic, 14,308,665; crucible, 78,760; electric 60,654; total, 15,019,333 metric tons. This is an increase of 1,320,695 tons, or 9.6%, over the preceding year.

Metal Markets

New York, Apr. 24—The metal markets are generally strong still, but there have been no special movements during the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess	
Gold				
Mar. 1912	$ 7,453,589	$ 4,335,678	Exp.	$3,117,911
" 1911	505,615	4,119,063	Imp.	3,613,448
Year 1912	19,958,088	12,414,195	Exp.	7,543,893
" 1911	1,854,014	19,465,737	Imp.	17,611,723
Silver				
Mar. 1912	5,806,307	3,711,734	Exp.	2,094,573
" 1911	5,896,795	3,197,409	Exp.	2,699,386
Year 1912	16,955,988	11,850,220	Exp.	5,105,768
" 1911	16,001,842	10,646,781	Exp.	5,355,061

Exports from the port of New York, week ended Apr. 20: Gold, $411,998, largely to Argentina; silver, $911,134, chiefly to London. Imports: Gold, $421,692; silver, $259,585, from Mexico and South America.

Gold—The price of gold on the open market in London remained at the usual level, 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Nothing further is said about exports from London to New York. The demand from India continues rather large, and South America is still taking some metal.

Gold in the United States April 1 is reported by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,028,432,369; in Treasury current balances, $172,841,816; in banks and circulation, $597,115,340; total, $1,798,389,525. Gold held against certificates includes bullion as well as coin.

Iridium—Prices are unchanged at $64 per oz. for pure metal, New York.

Platinum—While demand is only moderate, the metal continues immovable. Conditions do not favor any material change in prices at present. The Russian quotations are off a little, but this is thought to be only a temporary recession, due to local causes. Dealers quote $45.50 per oz. for refined platinum, and $48 per oz. for hard metal, up to 10% iridium.

Our Russian correspondent writes, under date of April 11 that the market is dull. The demand from abroad is insignificant. It is reported the inactivity of the market and the decrease of the prices on the local market are due to the sale below the market price of a large quantity of platinum by the Compagnie Industrielle de Platine, which controls about 80% of the platinum produced in Russia.

The prices remain nominal without change. The quotations are: at Ekaterinburg—9.90 rubles per zolotnik; in St. Petersburg—38,000 rubles per pood—equivalent to $37.22 and $37.24 per oz., respectively.

Silver—The market the last few days has been very active, silver having advanced today to 27⅞d., the highest point touched this year. The same price was recorded on Feb. 13, but with that exception silver has not been quoted so high since Nov. 6, 1907, when the official price was 28d. in London.

SILVER AND STERLING EXCHANGE

Apr.	18	19	20	22	23	24
New York	59¼	59⅜	59⅜	59⅜	59⅜	60⅛
London	27 7/16	27⅜	27 7/16	27 7/16	27 7/16	27⅞
Sterling Ex.	4.8720	4.8725	4.8730	4.8720	4.8720	4.8705

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver. 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Apr. 11, reported by Messrs. Pixley & Abell:

	1911	1912	Changes	
India	£2,831,400	£1,925,800	D.	£905,600
China	752,800	520,000	D.	232,800
Total	£3,584,200	£2,445,800	D.	£1,138,400

India Council bills in London averaged 16.05d. per rupee for the week.

Coined silver in the United States April 1, as estimated by the Treasury Department: Dollars, $565,269,367; subsidiary silver, $165,073,658; total, $730,343,025. Of the dollars $487,163,000 are held in the Treasury against silver certificates outstanding.

Copper, Tin, Lead and Zinc

NEW YORK

Apr.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
18	15⅞ @16	15.75 @15.85	43⅝	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
19	15⅞ @16	15.70 @15.80	43⅞	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
20	15⅞ @16	15.70 @15.80	44	4.20	4.10 @4.12½	6.65 @6.75	6.50 @6.60
22	15⅞ @16	15.70 @15.75	44⅝	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70
23	15⅞ @16	15.70 @15.75	44¾	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70
24	15⅞ @16	15.70 @15.80	44¾	4.20	4.07½ @4.12½	6.65 @6.85	6.50 @6.70

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Apr.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
18	70¼	71⅛	75⅛	198	194¾	16 5/16	25¾
19	70 3/16	71 1/16	75⅛	199⅛	196⅛	16 5/16	25¾
20	.....	.....	.....	.....	.....	.....	.....
22	69 13/16	70 13/16	75	203	199⅛	16 7/16	25¾
23	69¾	70⅝	74¾	203¾	200	16 5/16	25¾
24	70⅛	71⅜	75⅛	203½	200	16⅝	25¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The market has been dull during the week of Apr. 18-24 and the operations of second hands have been dominant. The foreign demand has been filled by speculative resales at concessions, causing the market over there to fall rather below our parity and precluding export sales from here. In our own market there have also been speculative realizations in business amounting to several millions of pounds, and the actual consumptive demand having disappeared, temporarily at least, there has been a small decline in price, these sellers having been willing to accept lower

prices than the principal agencies were asking. Although first hands have participated in this business to a certain extent, the position of the principal agencies has been reserved, the asked price of 16@16⅛c., delivered, usual terms, being generally maintained. Domestic consumers seem to be well covered for May and June and not yet disposed to contract for July. On the other hand, the producers claim to be well booked ahead. We have heard of some good buying of Lake copper at 15⅞@16c., and a small lot of a special brand is reported to have fetched 16⅛c. At the close, Lake copper is quoted at 15⅞@16c., and electrolytic, in cakes, wirebars and ingots, at 15.70@15.80c. Casting copper is quoted nominally at 15½@15¾c. as the average for the week.

The market for standard copper declined under realization of speculative holdings to £69 15s. for spot and £70 12s. 6d. for three months on Tuesday. On Wednesday, the offerings being scant, the market reacted, and closes at £70 10s. for spot, and £71 7s. 6d. for three months.

Copper sheets are 21@22c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire in 17@17⅛c. base, carload lots at mill.

Copper exports from New York for the week were 5149 long tons. Our special correspondent gives the exports from Baltimore at 75 tons.

Sales of Katanga copper at Antwerp are noted by *L'Echo des Mines*, of Mar. 25, being the first public sales of the metal. The Société Commercial Belge took 413,393 kg. at 154.25 fr. per 100 kg.; Osterrieth & Co. took two lots, 242,390 kg. and 295,149 kg., at 156.75 and 154.25 fr. per 100 kg., respectively. These prices are equivalent to 13.50c. and 13.72c. per lb. No allowance was made for copper containing cobalt.

Tin—The market has become very strong. The advance is not brought about by manipulation, but is due to the excellent statistical position of the metal. Buying on the part of consumers in this market has been satisfactory. The close is firm at £203 10s. for spot and £200 for three months in London, and about 44¾c. for April tin here.

Messrs. Robertson & Bense report the arrivals of tin ore and concentrates at Hamburg, Germany, in March, at 1077 tons; 1069 tons being from Bolivia and 8 tons from Southwest Africa.

Lead—The market is quiet. New York lead continues to be quoted at 4.20c., while lead at St. Louis is slightly easier at 4.07½@4.12½ cents.

The foreign market is very firm, and lead for early shipment continues scarce. Spanish lead is quoted at £16 12s. 6d., and English at 2s. 6d. higher.

Spelter—Consumers have not seemed disposed to contract for July spelter to any great extent, that delivery commanding about 6.50c., but there has been some demand for May and June and a fair tonnage for those months has been placed. Early deliveries have been liberally offered to consumers at about 6.65c. On the other hand the smelters do not seem disposed to press sales for the later deliveries. We quote at the close, 6.65@6.85c., New York, and 6.50@6.70c., St. Louis.

The foreign market is unchanged at £25 15s. for good ordinaries, and £26 for specials.

Base price of zinc-sheets is $8.65 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Zinc dust is quoted at 7⅛c. per lb., New York.

British Metal Imports and Exports

Imports and exports of metals in Great Britain, three months ended Mar. 31, figures in long tons, except quicksilver, which is in pounds:

Metals	Imports	Exports	Excess	
Copper, long tons	36,537	15,208	Imp.	21,329
Copper, 1911....	36,424	20,240	Imp.	16,184
Tin, long tons....	12,874	14,543	Exp.	1,669
Tin, 1911.....	10,786	12,948	Exp.	2,162
Lead, long tons..	52,925	11,544	Imp.	41,381
Lead, 1911.....	52,897	15,325	Imp.	37,572
Spelter, l'g tons..	33,972	2,135	Imp.	31,837
Spelter, 1911....	31,129	2,463	Imp.	28,666
Quicksilver, lb...	1,471,960	667,625	Imp.	804,335
Quicksilver, '11	547,264	962,078	Exp.	414,814
Minor met's, tons	1,813	6,649	Exp.	4,836
Minor, 1911.....	1,440	4,848	Exp.	3,408
Ores				
Tin ore and con.	7,562	.....	Imp.	7,562
Tin ore, 1911...	7,438	.....	Imp.	7,438
Pyrites	251,529	.....	Imp.	251,729
Pyrites, 1911...	256,022	.....	Imp.	256,022

Copper totals include metallic contents of ore and matte. Exports include reexports of foreign material. Miscellaneous metals include nickel, aluminum and the minor metals and alloys.

Other Metals

Aluminum—Business has been dull and sales small, chiefly on account of a strike which started in Cleveland and has extended to nearly all the works in the Central West which make aluminum into manufactured forms. Quotations are a shade weaker, at 20c. per lb. for No. 1 ingots, New York.

According to *L'Echo des Mines*, representatives of the American, French, Swiss and English producers of aluminum met recently in Paris to consider definite proposals for a basis of agreement as to prices and production—in other words for the reëstablishment of the old syndicate. Should the conference succeed in arranging for an advance, it would have little effect during 1912, since many large consumers have contracted for supplies for the year at present prices.

Antimony—Business has been quiet and prices are unchanged. Cookson's is 8@8⅛c. per lb.; Hallett's and U. S. are 7¾; while 6⅞@7c. is quoted for Hungarian, Chinese and other outside brands.

Quicksilver—Business has been good and the market is rather steadier. New York quotations are $41.50@42 per flask of 75 lb., while 60@62c. per lb. is charged for retail lots. San Francisco, $41.50 for domestic orders and $39 for export. London price is £8 7s. 6d. quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Zinc and Lead Ore Markets

Joplin, Mo., Apr. 20—The high price of zinc sulphide ore is $56, the base, per ton of 60% zinc, $50@53.50. The average price, all grades of zinc, $49.62. The high price of lead ore is $55, some ore selling on a base of $53 per ton of 80% lead. The average price, all grades of lead, $54.20 per ton.

Just at a time weather conditions seemed settled with favorable outlook for outputting, along came on Tuesday a slow, soaking rain of 36 hours, which the earth absorbed like a sponge. Again on Friday was another such rain for five hours. Tonight it is showers. The water-soaked earth is making the production of ore more hazardous, and is creating an in-

SHIPMENTS, WEEK ENDED APR. 20

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	3,174,930	.....	661,630	$100,412
Joplin.....	1,737,050	.....	191,580	51,290
Alba-Neck....	1,175,610	44,090	52,520	34,950
Galena.....	545,110	66,480	59,040	16,760
Miami.....	633,930	.....	63,460	15,340
Duenweg.....	477,960	128,250	44,950	15,000
Oronogo.....	261,930	.....	65,600	6,886
Jackson.....	259,050	.....	4,880	6,055
Spurgeon	120,410	187,500	.....	5,760
Granby	.....	336,610	6,560	4,995
Carl Junction	171,010	.....	.....	4,785
Lawton	122,910	.....	57,390	4,620
Cave Springs.	128,140	.....	14,690	3,855
Carthage ...	108,000	.....	.....	2,750
Springfield...	82,940	.....	.....	2,155
Quapaw.....	64,000	.....	.....	1,470
Aurora.....	44,000	.....	.....	1,000
Wentworth...	23,070	.....	.....	577
Totals.....	9,130,050	762,930	1,222,300	$278,660
16 weeks...	159,031,640	9,712,780	26,580,780	$4,640,381

Blende val., the week, $234.466; 16 weeks, $3,778,353
Calamine, the week, 11,158; 16 weeks, 139,015
Lead value, the week, 33,036; 16 weeks, 733,013

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1911	1912	1911	1912	1911	1912
January.....	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February....	40.21	45.75	39.16	43.31	54.46	52.39
March.....	39.85	51.56	38.45	49.25	54.57	54.64
April.....	38.88	.....	37.47	.....	56.37	.....
May.....	38.25	.....	36.79	.....	55.21	.....
June.....	40.50	.....	38.18	.....	56.49	.....
July.....	40.75	.....	38.36	.....	58.81	.....
August.....	42.50	.....	41.28	.....	60.74	.....
September..	42.63	.....	41.29	.....	59.33	.....
October.....	42.38	.....	40.89	.....	54.72	.....
November...	45.40	.....	43.25	.....	57.19	.....
December...	44.13	.....	40.76	.....	62.03	.....
Year.....	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

creased expense both in drainage and extra precaution against sliding ground. To these drawbacks was added a shortage of gas supply in portions of the district at intervals during the week. No unsold ore is reported in the bins, the stock being that portion of this week's output sold too late for loading. Lighter buying last and this week reduced this week's shipment to less than 5000 tons.

Platteville, Wis., Apr. 20—The highest price paid this week for zinc ore was $54.50; the base price of 60 per cent. zinc weakened from $53.50 to $52 at the week end. The base price paid for 80 per cent. lead ore was $53 per ton.

SHIPMENTS, WEEK ENDED APR. 20

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	1,134,800	.....	.....
Mineral Point	708,200	.....	.....
Benton	535,610	.....	512,000
Platteville	386,700	.....	.....
Hazel Green	346,800	.....	.....
Cuba City	312,690	87,670	127,300
Shullsburg	284,500	.....	.....
Livingston	220,000	60,000	.....
Harker	84,200	.....	.....
Montfort	84,000	.....	.....
Highland	59,800	.....	.....
Linden	.....	.....	80,000
Total	4,157,300	147,670	719,300
Year to date	60,519,040	1,769,530	6,879,650

Shipped during week to separating plants, 1,484,390 lb. zinc ore.

New Caledonia Ores

Exports of ores from New Caledonia in January included 3321 tons nickel ore to Great Britain and 6705 tons chrome ore to New York.

Chemicals

New York, Apr. 24—The general markets are in good condition and show no material change from last week.

Copper Sulphate—Business is on a good scale. Quotations are $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Arsenic—Demand continues good and supplies are not plentiful. For white arsenic $3.75@4 is quoted for spot, with $3.50@3.75 per 100 lb. for futures.

Nitrate of Soda—The market is steady and quotations are unchanged at 2.40c. per lb. for spot, and 2.40c. also for future positions.

Petroleum

The Standard purchasing agencies have raised the buying prices of crude oil in the East from 3 to 5c. per bbl., according to grade. This is the first change since January.

Mining Stocks

New York, Apr. 24—On April 18 the Stock Exchange was rather depressed. The tendency was to reaction, but price changes were small. The increase in Amalgamated dividend to $1 had been so far discounted that the announcement had little effect. On the Curb trading in mining stocks was slow and scattered, with some fractional losses.

April 19 trading declined on the Exchange and the movement was inclined to be narrow. The exception was a sudden spurt in Bethlehem Steel, 21,300 shares common and 23,300 preferred being sold at advances of 3¼ and 7½, respectively. On the Curb trading was confined mainly to a few specialties, and mining stocks were neglected.

April 20 the Exchange was more active. Fluctuations, however, were small. Bethlehem Steel lost some of its advances of the preceding day. On the Curb mining stocks were in better demand and inclined to be firmer in price.

April 22 the Exchange opened rather weak, but grew firmer, with advances in a few stocks. Dealings were on a moderate scale. The Curb was disturbed by the failure of J. Thomas Reinhardt, who has been a prominent promoter and a heavy dealer in Porcupine stocks.

April 23 there was a general upward movement on the Exchange, especially in a few favorite stocks. The Curb also showed a good demand for mining stocks, but advances were not well distributed, being confined to a few of the copper stocks and one or two Cobalts. Porcupines were weak. The strength of the market continued on April 24, and sales were large.

Boston, Apr. 23—The persistent strength of copper is well reflected in the copper-share market. One of the strongest arguments in favor of the permanency of the advance is the voluntary increase of miners' wages by the leading Lake Superior copper mines. Many new high prices on the present movement have been recorded the past week and the market has been animated in spots. Brief resting spells have been taken which served to solidify the technical position of the market.

Activity has been largely in the Calumet & Hecla subsidiary companies and the so called Dow stocks, notably Indiana and North Lake. Indiana has risen $7.50 to $22.75 on positive strikes by diamond drill giving promising metal indications. It will be remembered that this stock sold up in the 40's a few years ago on diamond-drill operations. St. Mary's Mineral Land came in for a deal of attention today by reason of its activity. There had been no sales for some time until today, but knowledge that a large block of stock which had been hanging over the market for some time had been sold caused a sharp $6.50 advance to $61.50 per share.

Tamarack recorded an extensive rise of $17 to $51, although it has not retained all the advance. Tamarack, it is claimed, is in a position through lower operating costs to earn dividends. In addition it has a small capitalization. Ahmeek has duplicated its record price

COPPER PRODUCTION REPORTS

Copper contents of blister copper, in pounds

Company	Jan.	Feb.	March
Alaska shipments	3,701,010	2,662,243	4,987,916
Anaconda	26,350,000	27,450,000	25,900,000
Arizona, Ltd	3,200,000	3,020,000	3,150 000
Copper Queen	6,748,264	6,046,860	7,197,121
Calumet & Ariz	4,544,000	4,452,004	4,652,000
Detroit	1,941,970	2,068,370	2,246,238
East Butte	1,520,000	1,440,000	.....
Mammoth	1,665,319	1,722,954	1,939,310
Mason Valley	600,000	1,100,000	.....
Nevada Con	6,309,228	4,888,790	6,380,000
Old Dominion	2,044,000	2,039,000	.....
Ray	2,475,945	2,140,000	.....
Shannon	1,550,000	1,300,000	1,388,000
South Utah	189,678	283,838	299,000
United Verde*	2,000,000	2,250,000	.....
Utah Copper Co	8,156,612	8,612,739	8,160,000
Lake Superior*	17,500,000	19,000,000	19,750,000
Non-rep. mines*	8,400,000	8,000,000	8,400,000
Total production	98,896,026	98,476,798	.....
Imports, bars, etc	31,790,590	18,976,513	.....
Total blister	130,686,616	117,453,311	.....
Imp. in ore & matte	8,340,740	10,432,438	.....
Total	139,027,356	127,885,749	.....
Miami	2,235,647	2,475,996	.....
Brit. Col. Cos.:			
British Col. Copper	538,190	860,003	.....
Granby	1,607,558	1,773,496	1,882,673
Mexican Cos.:			
Boleo	2,315,040	2,204,720	2,424,800
Cananea	3,552,000	2,948,000	2,834,000
Moctezuma	2,732,867	2,687,712	2,446,731
Other Foreign:			
Cape Cop., S. Africa	784,000	786,440	725,760
Kyshtim, Russia	1,170,000	1,055,000	.....
Spassky, Russia	795,200	649,600	.....
Famatina, Argen	172,480	.....	.....
Tilt Cove, Newf'd	153,257	109,059	104,992
Exports from:			
Chile	8,064,000	6,720,000	3,584,000
Australia	7,056,000	7,164,000	8,064,000
Arrivals in Europe†	13,144,320	10,868,680	12,559,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
III, 1911	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,6??
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167 904
II	116,035,809	56,228,368	63,148,096
III	125,694,601	67,487,466	58,779,566

VISIBLE STOCKS

	United States	Europe	Total
IV, 1911	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388
IV	62,367,557	136,819,200	199,186,757

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month.

of $300 made on the Curb just before it was taken over onto the Exchange.

Curb trading has been active and prices strong. Bohemia has given a good account of itself. The Porcupine issues suffered by the failure of one of the leading sponsors of these securities.

Assessments

Company	Delinq	Sale	Amt
Alameda, Idaho	Apr. 1	.....	$0.005
Algomah, Mich	Jan. 22	.....	1.00
Belcher, Nev	Apr. 8	Apr. 30	0.10
Black Jack, Utah	Feb. 6	.....	0.01
Boston Ely, Nev	Jan. 18	.....	0.50
Bullion, Nev	Apr. 30	May 20	0.05
Cedar-Talisman, Utah	Apr. 20	.....	0.005
Con. Imperial, Nev	Apr. 30	May 23	0.01
Con. Virginia, Nev	Apr. 24	May 15	0.20
Ely Con., Nev	.....	.....	0.05
Federal Ely, Utah	May 8	June 8	0.01
Gould & Curry, Nev	Apr. 19	May 10	0.05
Hale & Norcross, Nev	Apr. 12	May 3	0.05
Hancock, Mich	Mar. 28	.....	1.00
Houghton Copper, Mich	May 17	.....	1.00
Julia, Nev	May 15	June 5	0.05
Kentuck, Nev	Feb. 29	Mar. 19	0.05
Lehi Tintic, Utah	Feb. 29	.....	0.01½
Lower Mammoth, Utah	Mar. 16	.....	0.01
Michigan Cop. & Gold, Utah	May 15	May 30	0.002½
New York Bonanza, Utah	May 8	.....	0.02
O. K. Extension, Utah	Apr. 26	May 15	0.002½
Ojibway, Mich	Jan. 10	.....	1.005
Overman, Nev	Apr. 9	Apr. 30	0.05
Raven, Mont	Feb. 1	.....	0.10
Southwestern Miami, Ariz	Jan. 15	.....	1.00
Union Con., Nev	May 9	May 31	0.15
Utah Antimony, Utah	June 1	.....	0.03

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59 043	23.794	24.081	27.190
March	51.454	52.745	58.375	23.690	24.324	26.875
April	53.221	53.325	.....	24.483	24.595	.....
May	53.870	53.308	.....	24.797	24.583	.....
June	53.462	53.043	.....	24.651	24.486	.....
July	54.150	52.630	.....	25.034	24.286	.....
August	52.912	52.171	.....	24.428	24.082	.....
September	53.295	52.440	.....	24.567	24.209	.....
October	55.490	53.340	.....	25.596	24.594	.....
November	55.635	55.719	.....	25.680	25.649	.....
December	54.428	54.905	.....	25.160	25.349	.....
Year	53.486	53.304	.....	24.670	24.592	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139	14.698	12.447	14.868	54.704	65.884
April	12.019	.....	12.275	.....	54.034	.....
May	11.989	.....	12.214	.....	54.313	.....
June	12.385	.....	12.611	.....	56.365	.....
July	12.463	.....	12.720	.....	56.673	.....
August	12.405	.....	12.634	.....	56.266	.....
September	12.201	.....	12.508	.....	55.253	.....
October	12.189	.....	12.370	.....	55.170	.....
November	12.616	.....	12.769	.....	57.252	.....
December	13.552	.....	13.768	.....	62.068	.....
Year	12.376	.....	12.634	.....	55.972	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42 529	July	42.400	.....
February	41 614	42.962	August	43 319	.....
March	40.157	42.577	September	39 755	.....
April	42 185	.....	October	41.185	.....
May	43.115	.....	November	43.125	.....
June	44.606	.....	December	44.655	.....
			Av. Year	42.281	.....

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394	4.073	4.238	4.046	13.122	15.997
April	4.412	.....	4.262	.....	12.889	.....
May	4.373	.....	4.223	.....	12.984	.....
June	4.435	.....	4.292	.....	13.260	.....
July	4.499	.....	4.397	.....	13.530	.....
August	4.500	.....	4.406	.....	14.260	.....
September	4.485	.....	4.356	.....	14.744	.....
October	4.265	.....	4.139	.....	15.332	.....
November	4.298	.....	4.181	.....	15.821	.....
December	4.450	.....	4.332	.....	15.648	.....
Year	4.420	.....	4.286	.....	13.970	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563	6.626	5.413	6.476	23.016	26.048
April	5.399	.....	5.249	.....	23.743	.....
May	5.348	.....	5 198	.....	24.375	.....
June	5.520	.....	5.370	.....	24.612	.....
July	5.695	.....	5.545	.....	25.006	.....
August	5.953	.....	5.803	.....	26.801	.....
September	5.869	.....	5.719	.....	27.750	.....
October	6.102	.....	5.951	.....	27.256	.....
November	6.380	.....	6.223	.....	26.795	.....
December	6.301	.....	6.151	.....	26.849	.....
Year	5.758	.....	5.608	.....	25.281	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90	14.95	14.65	13.66	14.96	14.10
April	15.90	.....	14.65	.....	15.00	.....
May	15.90	.....	14.30	.....	14.72	.....
June	15.90	.....	14.06	.....	14.56	.....
July	15.90	.....	14.03	.....	14.53	.....
August	15 90	.....	14 00	.....	14 47	.....
September	15 90	.....	13 57	.....	14.40	.....
October	15.43	.....	13.44	.....	14.34	.....
November	14.92	.....	13.30	.....	14 25	.....
December	15.15	.....	13.10	.....	13.90	.....
Year	$15.72	.....	$13.94	.....	$14.49	.....

STOCK QUOTATIONS

COLO. SPRINGS Apr. 23

Name of Comp.	Bid.
Acacia	.05½
Cripple Cr'k Con	.01½
C. K. & N	.18
Doctor Jack Pot	.06⅜
Elkton Con	.67
El Paso	.78½
Findlay	.03½
Gold Dollar	.14½
Gold Sovereign	.02
Isabella	.12½
Jack Pot	.06
Jennie Sample	.06½
Lexington	.01
Moon Anchor	.01
Old Gold	.03⅜
Mary McKinney	.68½
Pharmacist	.02
Portland	.90⅜
Vindicator	.71½
Work	.01

SALT LAKE Apr. 23

Name of Comp.	Bid.
Beck Tunnel	.15
Black Jack	.20
Cedar Talisman	.02
Colorado Mining	.26
Columbus Con	.21
Crown Point	‡.04½
Daly-Judge	6.00
Grand Central	.68
Iron Blossom	1.27½
Little Bell	.42
Lower Mammoth	.03½
Mason Valley	‡12.00
May Day	.11½
Nevada Hills	2.31½
New York	.06
Prince Con	1.50
Silver King Coal'n	1.90
Sioux Con	.03⅜
Uncle Sam	.21
Yankee	.10

TORONTO Apr. 23

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡7.25	Hollinger	11.90
Hudson Bay	‡70.00	Imperial	.04
Temiskaming	.43	Pearl Lake	.09
Wettlaufer-Lor	.62	Porcu. Gold	.35
Apex	.04	Porcu. Tisdale	.04
Central	‡5.56	Preston E. D	.06
Crown Chartered	.24	Rea	.40
Dobie	‡.40	Standard	.04
Dome Exten	.50	Swastika	.22
Foley O'Brien	.20	West Dome	.20

SAN FRANCISCO Apr. 23

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.20	Belmont	10.00
Belcher	.80	Jim Butler	.68
Best & Belcher	.19	MacNamara	.24
Caledonia	3.25	Midway	.37
Challenge Con	.25	Mont.-Tonopah	3.45
Chollar	.12	North Star	.25
Confidence	.93	West End Con	2.10
Con. Virginia	.85	Atlanta	.29
Crown Point	.80	Booth	.12
Gould & Curry	.11	C.O.D. Con	.11
Hale & Norcross	.32	Comb. Frac	.16
Mexican	3.50	Jumbo Extension	.50
Occidental	.68	Pitts.-Silver Peak	1.37½
Ophir	1.42½	Silver Pick	.10
Overman	2.22½	St. Ives	.33
Potosi	.08	Tramp Con	.01
Savage	.21	Argonaut	2.25
Sierra Nevada	.37	Bunker Hill	5.00
Union Con	1.10	Cent. Eureka	.82
Yellow Jacket	1.25	So. Eureka	‡5.00

N. Y. EXCH. Apr. 23

Name of Comp.	Clg.
Amalgamated	82⅜
Am. Agri. Chem	60
Am.Sm.&Ref.,com	85¼
Am. Sm. & Ref., pf.	108
Am. Sm. Sec., pf. B	87¼
Anaconda	42⅜
Batopilas Min	2¾
BethlehemSteelpf	72¼
Chino	29⅜
Federal M. &S., pf.	43
Goldfield Con	4⅜
GreatNor.,ore, ctf.	41
Homestake	94
Miami Copper	25⅜
Nat'nalLead,com	57¾
National Lead, pf.	109
Nev. Consol	19⅞
Pittsburg Coal, pf.	91
Ray Con	19⅛
RepublicI&S,com.	23⅞
Republic I & S, pf.	78½
SlossSheffi'd,com.	47
Sloss Sheffield, pf.	‡100
Tennessee Copper	41⅜
Utah Copper	63⅜
U. S. Steel, com	71⅝
U. S. Steel, pf.	112⅞
Va. Car. Chem	50⅜

N. Y. CURB Apr. 23

Name of Comp.	Clg.
Barnes King	⅛
Beaver Con	.44
Braden Copper	5⅜
B. C. Copper	5⅜
Buffalo Mines	‡1⅛
Butte & Vipond	‡.53
Caledonia	.70
Con. Ariz. Sm	⅛
Davis-Daly	1⅜
Diam'field-Daisy	11
Ely Con	⅛
Florence	.78
Giroux	5⅞
Gold Hill Con	‡¼
Greene Cananea	9⅛
Greenwater	.08
Guggen. Exp	2.88
Inspiration Con	19⅜
Internat. S. & R	‡126
LaGrange Placer	‡2⅝
Kerr Lake	2¾
La Rose	3⅛
McKinley-Dar-Sa	1⅛
Min. Co. of A. new	3
Nev. Utah M. & S	⅛
Nipissing Mines	7⅝
Ohio Copper	1⅝
Pacific Sm. & M	¼
Precious Metals	‡1⅜
Ray Central	2⅜
Red Warrior	‡1⅛
South Utah M. &S.	1
Standard Oil (Old)	880
Stand'd Oil of N.J.	385
Stand'd Oil Subs.	508
Stewart	1⅜
Tonopah	7⅛
Tonopah Ex	2⅛
Tri-Bullion	⅛
Tularosa	⅛
United Cop., pfd.	15
Yukon Gold	3⅛

BOSTON EXCH. Apr. 23

Name of Comp.	Clg.
Adventure	9⅛
Ahmeek	300
Algomah	7⅝
Allouez	47½
Am. Zinc	27⅝
Ariz. Com., ctfs.	6
Bonanza	⅛
Boston & Corbin	8
Butte & Balak	4½
Calumet & Ariz	73½
Calumet & Hecla	494
Centennial	26½
Con. Mercur	.06
Copper Range	64
Daly West	6¾
East Butte	14⅜
Franklin	14½
Granby	87¾
Hancock	33¾
Hedley Gold	17
Helvetia	1⅞
Indiana	22¾
Island Cr'k, com	44
Island Cr'k, pfd	88½
Isle Royale	28½
Keweenaw	2
Lake	46½
La Salle	7⅞
Mass	8
Michigan	4½
Mohawk	65⅝
New Arcadian	5¼
New Idria Quick	6⅞
North Butte	32½
North Lake	8⅜
Ojibway	5⅞
Old Dominion	55¾
Osceola	118
Quincy	88½
Shannon	14½
Shattuck-Ariz	21
Superior	37
Superior & Bost	3
Tamarack	46
Trinity	8
Tuolumne	3¾
Union Mines	3½
U. S. Smelting	39¾
U. S. Smelt'g, pf.	49
Utah Apex	2¾
Utah Con	15
Victoria	4¾
Winona	6½
Wolverine	113¾
Wyandot	2½

BOSTON CURB Apr. 23

Name of Comp.	Last
Bingham Mines	3
Boston Ely	2¼
Boswyocolo	.03½
Butte Central	7⅛
Cactus	.14
Calaveras	2⅞
Chief Cons	1½
Corbin	2½
Cortez	1
Crown Reserve	3½
First Nat. Cop	3⅞
Majestic	.75
Mazatan	.60
Moneta Porc	.15
Nevada-Douglas	4½
New Baltic	3½
Oneco	3½
Raven Copper	.41
Rhode Island Coal	.10
San Antonio	‡3
S. W. Miami	9
South Lake	7½
Trethewey	.58
United Verde Ext.	.43
Vulture	‡5.00

LONDON Apr. 24

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolcres	1 10 0
El Oro	0 16 9
Esperanza	1 13 9
Mexico Mines	6 17 6
Oroville	0 4 6
Stratton'sInd.	0 3 1½
Tomboy	1 2 6

‡Last quotation.